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A PRIZE OF ONE HUNDRED DOLLARS.

The ELECTRICAL REVIEW desires to publish an article upon the electric lighting central station superintendent—his duties, how he may best fit himself for them, what steps he must take to insure success in that profession, and what type of man is best fitted by character, experience, education and brain texture for employment under conditions of great responsibility by owners of such installations. We offer a prize of $100 for the best article of not less than three thousand nor more than five thousand words in length, received before May 1, 1901. Only articles written by members or associate members of the American Institute of Electrical Engineers, or members of the National Electric Light Association will be considered.

THE FUTURE OF COPPER.

There have been some pessimistic people who have looked on the one hand at the enormous extension of the applications of electricity and on the other to the apparent exhaustion of the world's visible supply of copper, and have predicted that copper would so advance in price as to become an impossible substance for use in large quantities in electrical undertakings.

This view of the subject is not particularly worthy of respect, because it overlooks entirely the fact that the advance in electricity has made two things possible. One of these is the production in enormous quantities of aluminum, which seems destined largely to replace copper as a material for conducting lines, and the other is that electricity itself is a most valuable and useful adjunct in the winning of copper from low-grade ores and from those which would otherwise possibly not be worked at all. Hence the electrical engineer has provided his descendants not only with the easiest and best method of securing the valuable metal which is so useful to him, but also with a substitute for it in case of urgent necessity.

It would not be absolutely true to say that electricians would not feel natural distress at the exhaustion of the world's copper supply, but they may look ahead without fear, because it is demonstrable that by the aid of electrical methods there will always be enough copper, and that aluminum, even if not used to a large extent as an electrical conducting metal, will still take the place of copper and brass very largely in other directions and leave more of the red metal available for electrical uses. We may therefore look ahead with equanimity at the future and with the belief that the price of copper will not get so high as to embarrass electrical extensions in coming years.

THE INSTITUTE.

There has been a recent apparent tendency on the part of members of the American Institute of Electrical Engineers to neglect the regular meetings of that body and attendance at these meetings has been comparatively small of late. For this state of things there must be some good and sufficient reason, and it seems not unlikely that this must be found in the papers which form the programme. The ideal condition of things in such an institution consists of original papers read by the authors before a considerable body of the members and discussed at length subsequently. It has not been found of late that this condition has been approached. There seems not to have been any strenuous effort made lately towards securing papers of timely value from the many members capable of writing them. It is not pleasant to think that the membership of the Institute is losing its interest in the work, but the suggestion may be offered—without the least intention of offense—that a good deal of the interest which has visibly waned away might be brought back by judicious action on the part of the committee on papers.

ELECTRICITY AND MODERN PHYSICS.

There has been for many years a sort of reproach brought to bear upon electrical engineers because they have been unable to define electricity or to state even in general terms what this mysterious and extraordinary agency is. Of course the fact that the same statements apply equally well to the action of gravitation—phenomena that have been observed since the earliest dawn of time—has been lost sight of, but this is true and it is only of late that we have seen any reason to believe that we would ever come closer to an understanding of the fundamental principles underlying the relations of matter and force.

In the century just closed the brilliant

research of Faraday, followed by the analysis of Maxwell and verified by the experiments of Hertz, made it evident that light is a variety of electrical and magnetic action. To put it in other words, the result of the labors of these physicists was a demonstration of an inter-relation between these natural manifestations, and a series of definitions which expressed in definite terms the nature and character of this relation. Since the beginning of the last century, however, it has been found absolutely necessary to conceive of the existence of an imponderable substance called the ether filling space and filling even the interstices between the final portions of matter, atoms and molecules, or whatever they may be.

In this ether and in the ultimate particles of matter take place the actions that we call electrical as well as those which manifest themselves as gravitation, magnetism and heat. Hence there has been focused upon the consideration of the ether itself and of the structure of matter the attention of the whole world of physicists for more than half a century. A number of theories have been propounded and hypothesis after hypothesis advanced, held a while and found wanting in ability to account for observed actions.

It has been perfectly easy to see for a long time that, whatever electrical action may finally be defined to be, it takes place in the ether rather than in matter itself. The inter-relation between electricity and magnetism, the phenomena of the radiation of electrical and magnetic waves in space, and the propagation of waves along conductors, have been studied with the utmost care and the various hypotheses assumed at the beginning have been practically demonstrated to be true; yet after all these years of research we find ourselves limited so far as an accurate definition of electricity is concerned to what is practically begging the question and shifting the responsibility. The total sum of knowledge on the subject to-day may be expressed by the statement that if an ether exists, having definite and assumed physical powers, then electricity and magnetism are both manifestations of stress, strain and flow in it.

It has lately been suggested that gravity may also be explained as an electrical phenomenon just as light has been, or that in other words the mysterious actions of nature may be reduced somewhat in their complexity by considering them all as effects of mechanical disturbances in the supposed ether. Much of our faith in the simplicity of the molecule and the atom has been shaken by recent chemical and physical work. From the latest and strongest evidence that has been brought to bear upon the subject, it seems likely that before long we must revise our conception of the elementary nature of the molecule and the indivisible character of the atom. Recent experiment has brought to light facts which seem to require for their full explanation the assumption that an atom may be divisible, or at least that it may be accompanied by small satellites which may be detached from the parent mass. At the same time late chemical research goes to prove that the old assumption of the structure of complex molecules is reasonably near correct, while the brilliant research and analysis of Arrhenius and Van't Hoff has led us to an altogether new conception of the state of the ether immediately surrounding molecules and atoms, or, to put it into other words, of the electrical charges resident upon them.

Taking, then, a broad view of the present state of scientific knowledge on the subject of the structure of matter and the nature of electricity, it seems safe to say that while we are still far from an accurate definition of either, yet we are measurably nearer to it than we were twenty years ago; and that doubtless the explanation, when forthcoming, will reduce practically all of the mysteries of action at a distance to simple movements and stresses in the ether. To put it another way, the explanation toward which we seem to be tending will substitute for the mysteries with which we now have to contend those belonging to the ether, and it seems not unlikely that we are approaching the limit of possible knowledge in this regard.

Notwithstanding our inability to conceive or define the ultimate nature of things, we can congratulate ourselves upon the astonishing progress we have made in our utilization of natural forces and their application. It does not seem likely that we shall ever know what the ultimate nature of matter is or what the ether is like or how it is constructed, although we may refer back to the fundamentals and show that all actions with which we are familiar are due to the inter-relation of force and matter and ether. It seems possible, not to say probable, that this point is the one at which research must stop, for the reason that it is unlikely that we will ever be able to comprehend the essential nature of these things with our merely finite minds. The new physics has made a long step toward the correllation of physical manifestations and it seems as if virtually all actions would be called, in one way or the other, electrical. This, though, as any one can see, is not an explanation of electricity, but is simply a shifting of the point of view, and a rechristening of familiar manifestations with new names.

A brief notice regarding the import trade of Argentina appears in another column and shows a remarkable state of affairs. There seems to be no good reason to doubt the figures, as they were deduced by one of the leading commercial agencies. We, as a nation, have rapidly caught the pace of England in general exports throughout the world, but in this specific instance we are easily distanced by Great Britain, Italy and Germany. Such a statement as this sounds a note of warning to our exporters, too grave to be neglected. The figures given do not show what proportion of the total represents electrical apparatus and material, but judging from the prominence of electrical enterprises throughout South America it is only reasonable to believe that a considerable amount of the whole sum was paid for such goods. Germany is ever alert and keen to compete with us in every line of outside trade, England has the prestige of years to aid her, and Italy is developing in a formidable manner. With three such powerful rivals is it prudent for us to lie back on our reserve strength, or to count upon what we can do if we will?

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XX.

BY W. ELWELL GOLDSBOROUGH.

Now, since in circuits containing constant inductive reactance and a variable resistance, the energy expended is a maximum when the resistance equals the reactance, if this substitution is made in (182) we find that the maximum amount of energy that can possibly be expended in a circuit as long as (x) remains constant is

$$P_{max.} = \frac{\bar{E}^2}{2x} = \frac{E^2}{4x} \qquad (184)$$

where $\bar{E}$ is the virtual and E the maximum value of the impressed electro-motive force.

Example No. 11.

An electro-motive force of 60 volts at 30 cycles is impressed upon a circuit containing a variable resistance connected in series with an induction coil having a fixed inductance of .0064 henry.

Determine the values of the resistance of the circuit, the current and the power developed in the circuit, when the resistance variations are such as to cause the phase of the current to vary from 0 to 90° by successive increments of 10° each.

Since by equation (55),

$$\phi = \tan^{-1}\frac{x}{r},$$

when the reactance of a circuit is constant the value of the resistance, in terms of this reactance and the angle of lag, is expressed by the equation,

$$r = \frac{x}{\tan\phi} \qquad (185)$$

Again, when the value of the resistance of a circuit is known, as well as the values of its inductance and the impressed electro-motive force, the value of the current is given by equation (54)

$$\bar{I} = \bar{E} \div z$$

and the value of the power developed in the circuit by equation (91),

$$P = \bar{E}\,\bar{I}\cos\phi. \qquad (91)$$

If now we substitute in (185) for the value of ϕ, 0°, 10°, 20°, 30°, 40°, 50°, 60°, 70°, 80° and 90° respectively, and determine the corresponding values of $\bar{I}$ and P, the requirements of the problem will be met. This procedure gives us the values tabulated in Table 3 of the different quantities involved. In Fig. 53 these data are shown plotted to convenient scales. The dotted radial lines show the relative phase positions of the quantities,

TABLE 3.

ϕ	$\tan\phi$	r	$\bar{I}$	$\cos\phi$	P	ϕ
0	0	∞	0	1.0 0	0	0
10	.176	6.91	8.7	.985	513	10
20	.364	3.30	17.1	.940	964	20
30	.577	2.08	25.0	.866	1,300	30
40	.839	1.43	32.2	.766	1,480	40
50	1 192	1.01	38.3	.643	1,480	50
60	1.732	.69	43.3	.500	1,300	60
70	2.748	.44	47.0	.342	964	70
80	5.671	.21	49.2	.174	513	80
90	∞	0	50 0	0	0	90

as the curves cut the dotted lines at points the radial distances of which from the centre O are proportional to the tabulated values.

The point of maximum power, as illustrated, falls between the 40° and 50° positions, and by substitution in (184) is determined to be

$$P_{max} = \frac{\bar{E}^2}{2x} = \frac{\overline{60}^2}{2 \times 1.2} = 1{,}500 \text{ watts.}$$

If a series circuit in which variations in the resistance occur includes a constant reactance that is due to capacity instead of to inductance, a cycle of changes will be observed, when the resistance fluctuations take place, that do not differ sensibly from those just discussed in connection with Fig. 53. A capacity reactance

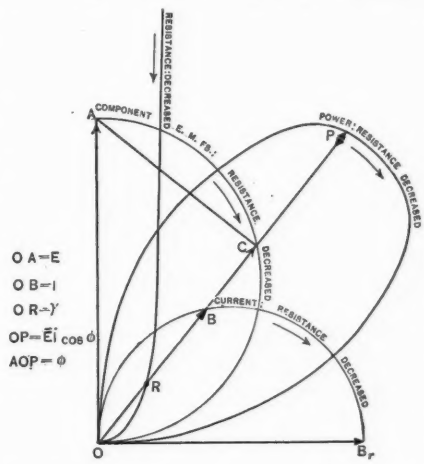


FIG. 54.—ALTERNATING-CURRENT MECHANISMS.

necessarily causes the current to advance ahead of the impressed electro-motive force, and on this account the phase angles will all be angles of lead when capacity reactance predominates and the resistance varies. This, however, is the only difference, theoretically, between dominant inductance and dominant capacity conditions, and consequently the phase diagram for the capacity reactance circuit can be made to be entirely symmetrical with Fig. 53, relatively to the impressed electro-motive-force vector OA of Fig. 53.

Fig. 54 illustrates this fact. The vector OA represents the impressed electro-motive force. The vector OB a value and phase position of the current for a particular value of the line resistance. The angle of phase difference AOB is determined directly from the dimensions of the circuit by equation (146) by which

$$\phi = \tan^{-1}\frac{1}{C\,\omega\,r}$$

and is laid off in advance of the electro-motive force in determining the vector position of the current.

By equation (138) the impressed electro-motive force, which is a constant, is equal to

$$E = \sqrt{E_r^2 + E_c^2}$$

and, therefore, the electro-motive-force vector triangle AOC will always be a right-angled triangle described on E as an hypotenuse, whatever value is given to the resistance in the circuit; and so the heel C of the triangle will always fall on the semi-circle ACO described on OA as a diameter, since $OC = E_r = I\,r$ and $CA = E_c = I \div C\,\omega$. When, therefore, ($r$) is reduced in value C will move along the semi-circle towards O, since when (r) is very large $I\,r$ approximates, both in value and phase, the vector OA.

When (r) is very small ($I \div C\,\omega$) in turn closely approximates OA in value, but takes a phase position directly opposite to it, since the vector OC, which closes the vector triangle, approaches a zero value under these conditions.

In this circuit the current is necessarily always in phase with E_r, and since as (r) decreases OC moves from a position in which it coincides with OA to one in which it is tangent to the semi-circle ACO at O, the phase position of the current changes from an angular advance of zero degrees to an angular advance of 90°. During this change in phase I must undergo a change in value that is proportional to the variations of E_c, since $E_c = I\,x$, and x is constant; therefore the locus of the point B is a semi-circle described on a diameter OB_c that is at right angles to OA. For the current is always 90° in advance of the reactance electro-motive force, and the locus of the head of the reactance electro-motive-force vector is the semi-circle ACO described on OA as a diameter.

By prolonging the vector OB, in its successive positions until it attains a length that is equal to the product of $\bar{I}$ and $\bar{E}_c$, we obtain a curve that shows the limits of the power developed in this capacity reactive circuit that is entirely analogous to the "power" curve of Fig. 53. This curve has a maximum displacement from O when the current has a lead of 45°. That this is true can be easily verified by applying equation (183) to the case in hand.

We have the rule, therefore, that

The power developed in a reactive circuit is a maximum when the resistance of the circuit is made equal to the reactance of the circuit.

In any circuit in which the reactance is a constant, the current is a maximum when the resistance of the circuit is re-

duced to zero. Under these circumstances the value of the current is

$$I_r = \frac{E}{x}$$

If in the circuit inductance is the reactance factor the value of the current is

$$I_r = \frac{E}{L\,\omega}$$

a quantity that is illustrated by the vector OB_r of Fig. 53. If, on the other hand, capacity is the reactance factor of the circuit, the value of the current is

$$I_r = EC\,\omega$$

a quantity represented by the vector OB_r of Fig. 54.

In the simple series circuit there is another factor which when it is a variable causes modifications in the conditions of balance existing between the forces that are not less interesting than those resulting from variable resistance. We are quite as likely to meet with conditions in which we are confronted with a *variable reactance* and a *constant resistance* as we are to meet conditions of variable resistance and constant reactance. In studying the phenomena due to variable reactance we will first consider a simple circuit containing resistance and inductance.

In such a circuit, as has already been pointed out [see equation (181)],

$$E^2 = (I\,r)^2 + (I\,x)^2$$

or the square of the impressed electro-motive force is equal to the sum of the squares of two component electro-motive forces. If, therefore, the impressed electro-motive force is constant it will be the diameter of a circle the perimeter of which is the locus of the vertex of a right-angled triangle formed by two sides $(I\,r)$ and $(I\,x)$ of variable length upon the diameter E as hypotenuse. Such a triangle is shown in Fig. 55 at OAC_l. In this triangle the lengths of the sides are dependent upon the value of the reactance (x), since E and (r) are constants. By equation (54) the value of I also depends upon (x).

Moreover, by (54), when (x) is large relatively to (r), although I is small, $I\,x$, the reactive electro-motive force, approaches E in value, while $I\,r$, the resistance electro-motive force, approaches a zero value. When, therefore, (x) is very large C_lA is large and OC_l is very small, and the point C_l assumes a position on the circle close to but on the left of the point O.

Now, since the tangent of the angle C_lOA is equal to

$$\tan \phi_l = \frac{x}{r}$$

when (x) decreases in value the angle ϕ_l will diminish, and the side OC_l will close in on the stationary side OA, and consequently C_l will move along the circle from O towards A. When (x) becomes small (r) will be large by comparison, and therefore by (181), $(I\,r)^2$ will approximate $(E)^2$ in value, while $(I\,x)^2$ will approach a zero value. When (x) is very small, therefore, C_l approaches A, and finally, when $x = o$, C_l coincides with A, $I\,r = E$ and $\phi_l = o$.

Now with each change in (x) the impedance of the circuit changes, and since $I = E \div z$, if (x) constantly diminishes, I will constantly increase. To determine the locus of the extremity B_l of the current vector OB_l as (x) diminishes we have only to refer again to equation (181). Since, under the present conditions, (r) is a constant in this equation. I must vary with $I\,r$; but we have just demonstrated that the vector head C_l of OC_l moves along the circle OC_lA as a locus; therefore, the vector head B_l of OB_l must also move along a circle as a locus. For OB_l is in phase with OC_l, and swings about the same point o as a centre, therefore since they are proportional to one another the points B_l and C_l must describe similar figures.

The diameter of the locus circle OB_lB is determined by making (x) equal to zero in equation (54) when

$$OB = I_{max.} = E \div r.$$

For the same reasons that that part of Fig. 55 which lies to the left of the line OA illustrates the variations occurring in a circuit containing series reactance and inductance, when the inductance is a variable, that part of Fig. 55 which lies to the right of OA illustrates the variations occurring in a circuit containing series resistance and capacity when the capacity is a variable. When, in the circuit we have just been considering, $x = o$ and OB is in phase with OA, the conditions are such that they represent a circuit containing resistance and capacity in series; but the *value of the capacity is infinity*.

That this is true is quickly seen by referring to equation (145), page 155, where

$$I = \frac{E}{\sqrt{r^2 + \frac{1}{C^2\,\omega^2}}} \qquad (145)$$

and to equation (146), giving the value of the phase angle,

$$\phi = \tan^{-1} \frac{1}{C\,\omega\,r} \qquad (146)$$

between the current and impressed electro-motive force. These equations show that in circuits containing resistance and capacity, for a given resistance, the impedance of the circuit is only a minimum and the angle ϕ only zero when the capacity equals infinity.

If the capacity is reduced in value, a capacity reactance immediately becomes prominent in the circuit and induces a reactance electro-motive force, which with the resistance electro-motive force also fulfils the condition,

$$E^2 = (I\,r)^2 + (I\,x)^2 \qquad (181)$$

Therefore, with decreasing capacity a right-angled triangle appears on the right of OA, the heel C_c of which follows the continuation of the perimeter of the circle described on OA as a diameter. When the capacity reactance equals the resistance of the circuit, both OC_c, the resistance electro-motive-force vector, and C_cA, the reactance electro-motive-force vector, make angles of 45° with OA, and C_c assumes a position half-way between A and O on the perimeter. A still further reduction in the value of the capacity C causes the point C_c to approach nearer and nearer the point O, until when $C = 0$, C_c coincides with O and the reactance electro-motive force equals the impressed electro-motive force in value. The condition of *zero capacity* is a condition of "*open circuit*" on the line, as it is a condition in which the areas of opposed condenser plates are reduced to zero. Between the limits of infinite and zero capacity in the line the current in the circuit undergoes changes in value that are proportional to the changes in the resistance electro-motive force, since

$$E_r = I\,r \text{ and } \frac{E_r}{r} = I.$$

Therefore, the vector head B of the current vector OB follows the locus BB_cO as the capacity decreases and becomes equal to zero when the capacity equals zero.

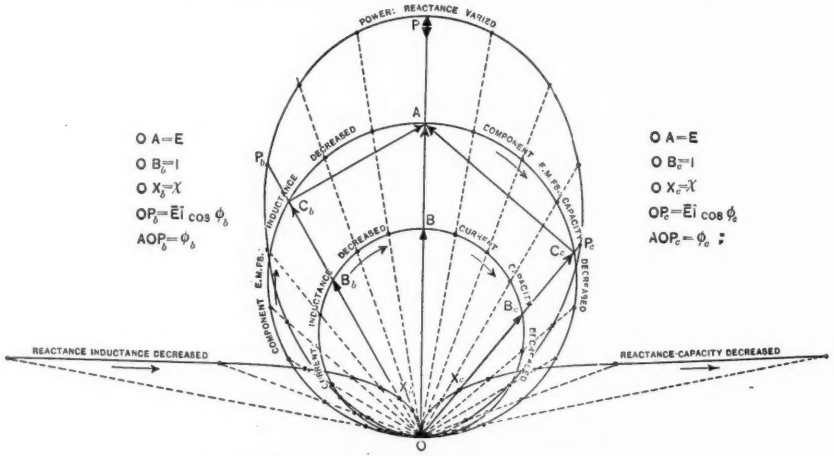


FIG. 55.—ALTERNATING-CURRENT MECHANISMS.

Science Brevities

Electricity from Peat—From the Continent comes the statement that it is proposed to utilize the great peat beds of North Germany for the generation of electricity on a large scale, says the *Electrical Engineer*. The matter has been fully considered by Dr. Franks, and he estimates that a hectare of turf three metres thick gives 2,500 tons of dry turf, equivalent to 1,200 tons of coke, or in English measure, an acre of turf 10 feet thick gives 1,000 tons of dry turf, equivalent to 480 tons of coke. The mosses of the Evus Valley, which cover an area of 1,000 square miles, might furnish the equivalent of 300,000,000 tons of pit coal —that is to say, more than the total production of Germany for three years. The turf would be burnt at central stations of 10,000-horse-power capacity, consuming annually 200,000 tons of turf, the product of 200 acres of the beds. One application of the power produced would be to the service of the canal connecting Dortmund to the Evus, which will soon be finished, but the author thinks the most interesting will be the manufacture of acetylene, the materials for which can be obtained easily and cheaply in the neighborhood. With 10,000 horse-power, a quantity of acetylene can be produced daily equivalent for lighting purposes to 150,000 gallons of petroleum, or annually in value to 20,000 tons of foreign imported petroleum.

Atmospheric Electricity—Herren Elster and Geitel have published in the *Physikalische Zeitschrift*, some further accounts of their work on the measurement of electrical leakage in free air and in closed spaces. Dr. Geitel finds that with regard to the air in a closed vessel, with an initial charge of 240 volts (independently of the sign of electrification) the leakage from an insulated body amounted to about 0.4 per cent per minute; on the second day the leakage amounted to 1 per cent, and on the fourth day to 1.4 per cent. After this period the leakage became slower, and gradually attained a limit of about two per cent per minute. A full description is given of the apparatus employed. He also found that the leakage was not proportional to the charge of electricity, but that for charges varying from 80 to 240 volts the amount remained constant. This phenomenon was pointed out by Matteucci in 1850, but the observation remained practically unnoticed. Further, Dr. Geitel found that the influence of daylight or of artificial illumination was not perceptible on the results obtained.

Liquid Air Explosives—The experiments made with a view to using liquid air as one of the constituents of an explosive are described by Mr. A. Larsen in a paper before the British Institution of Mining Engineers. The cartridges used for blasting trials in the Simplon tunnel consisted of a wrapper filled with a carbonaceous material, such, for instance, as a mixture of equal parts of paraffin and of charcoal, and dipped bodily in liquid air until completely soaked. The cartridges were kept in liquid air at the working face of the rock until required for use, when they were put quickly in the shot-holes and detonated with a small guncotton primer and detonator. The life of such a cartridge is, unfortunately, very short after the cartridge has been removed from the liquid air. A cartridge eight inches in length and three inches in diameter has to be fired within 15 minutes after being taken out of the liquid to avoid a miss-fire. On this account the Simplon trials were discontinued; nevertheless, Mr. Larsen says that much attention is still being devoted to the matter in Germany, where investigations are being carried on in three different centres, one of them being the largest explosive works on the Continent, namely, the carbonite factory at Schlebusch.

Ammonium Amalgam—The much-debated question of the existence of an ammonium amalgam would appear to be finally settled in the affirmative as the result of recent researches. The fact that the volumes of ammonia and hydrogen evolved from ammonium amalgam are in the ratio of 2.1 has been regarded as evidence in favor of Berzelius's ammonium theory, but the inability of ammonium amalgam to effect the reduction of the heavy metals from their salt solutions, in opposition to potassium and sodium amalgam, spoke strongly against the theory. The investigation of the electrolytic tension of decomposition of the ammonium salts with a mercury cathode, by Coehn and Dannenberg, described in the *Zeitschrift für anorganische Chemie*, has given results perfectly analogous to those obtained with salts of the alkali metals, a result only explicable on the assumption of the ammonium theory. Experiments carried out under varying conditions to ascertain the possibility of reducing the heavy metals from their solutions, show that the negative results previously obtained are due to the great instability of the ammonium amalgam, says a British scientific journal. By preparing the amalgam electrolytically at low temperatures (0 degree centigrade), when it appears to be much more stable and does not exhibit to any great extent the spongy appearance peculiar to the amalgam prepared under ordinary conditions, and allowing it to act on cold solutions of copper, cadmium and zinc salts, the formation of the corresponding heavy metal amalgams is easily observed. In the case of the copper, it might be possible to explain the reduction by attributing it to the nascent hydrogen generated in the decomposition of the ammonium amalgam; but this explanation is not possible in the case of the cadmium and zinc salts.

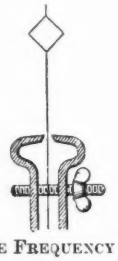
X-Ray Transformations—Some new experiments by M. G. Sagnac on the transformations of Rœntgen rays by matter have been described in the *Bulletin* of the French Physical Society. The study of the electric action of the secondary rays emitted by a body affords a test of the presence of small quantities of relatively active substances such as copper, iron, aluminum. Hence, also, a method of searching for new elements. The energetic absorption of the more active rays from such a metal as platinum in the first few millimetres of adjacent air has been verified directly by rarefying the air surrounding the metal. Finally, a pencil of Rœntgen rays discharges a conductor even when it does not pass through the portion of air acted on by the electric field of the conductor. It is sufficient that the rays shall traverse a portion of air separated from the field of the conductor by a Faraday screen (such as a metal gauze), and that there shall be a field of force in the part traversed, of like sense to that due to the conductor. If the charge of the conductor is reversed in sign, the rate of discharge is altered in the ratio of 1 to 10 or 20, but in the absence of the field in the second region no such change takes place. M. Sagnac's explanation of the phenomena is that the ions produced in the second region acquire, under the influence of the external field, sufficient kinetic energy to carry them through the openings of the screen into the region surrounding the conductor.

Radioactive Lead—A paper by Messrs. K. A. Hoffman and E. Strauss on "radioactive lead" appears in the *Berichte*. This material is extracted from various minerals such as pitchblende, cleveite, broggerite, copperuranite, samarskite and euxenite, and resembles lead in being precipitated from its acid solution by sul-

phuretted hydrogen, in forming a sulphate insoluble in dilute sulphuric acid, and in having a yellow iodide. It differs from lead in the fact that it acts upon a photographic plate in the dark; it possesses a characteristic violet line in its spark spectrum, and its equivalent is markedly different, being 65.05 as against 51.7 for lead. The authors regard their results as being due to the presence of an element of an atomic weight of over 260, probably either divalent or tetravalent.

Atmospheric Gases—A valuable contribution to the study of the inert gases of the atmosphere is made by Professors Liveing and Dewar in a paper read before the Royal Society, says the *Popular Science Monthly*. The gases were obtained by liquefying air by contact with the walls of a vessel at atmospheric pressure cooled below 200 degrees centigrade. Some 200 cubic centimetres of liquid air were thus condensed, and the more volatile portion was then distilled over into a receiver cooled with liquid hydrogen. This portion, consisting of about 10 cubic centimetres, was then passed into spectrum tubes, first, however, traversing a U-tube immersed also in liquid hydrogen. In this manner the gas was completely freed from every trace of nitrogen, argon and compounds of carbon. The tubes showed the spectra of hydrogen, helium and neon with great brilliancy, but also a large number of lines which could not be referred to any known origin. This shows conclusively that a sensible proportion of hydrogen exists in the earth's atmosphere, a point which has been much disputed in the past. If it be true, as has been shown mathematically, that owing to the velocity of the hydrogen molecule, the earth can not retain this gas in its atmosphere, then there must be a continued accession of hydrogen to the atmosphere from interplanetary space. If this is the case, it is probable that there must be a similar transfer of other gases, and therefore the authors of the paper sought in the spectra evidence of the presence of the characteristic lines of the spectra of nebulæ, of the corona, and of the aurora. Nebular lines were found in the tubes as above prepared; but in one, the gas of which had not been passed through the U-tube, and which contained traces of nitrogen and argon, a line was found very close to the principal green nebular ray, which did not appear in the other tubes, and which may indicate that the substance that is luminous in the nebulæ is really present in the earth's atmosphere. Several lines were found which may possibly be referred to coronal rays, but further study is necessary before this can be established. Still, more doubt attaches to the auroral rays, one of which seems to be identical with a strong ray of argon. The ingenious method devised for the collection of the gases, the demonstration of the presence of hydrogen in the atmosphere, and the possibilities opened up by this manner of attack render this research notable.

Frequency of Alternating Currents—A good many simple devices for determining the periodicity of an alternating current have been described already, but probably the simplest yet devised is that of R. Wachsmuth, says the *Electrician*. It consists of a piece of watch spring (see diagram) clamped in a vice, and provided with a small square piece of white paper stuck on by means of a bit of wax. When this is illuminated by a source fed by an alternating current and set vibrating, it will



A Simple Frequency Meter.

appear to stand still when the frequency of the current equals its own frequency of oscillation. The latter can be calculated from the formula, $N = 7{,}920$ thickness in millimetres / (length in centimetres)^2, but in practice a graduation could be easily marked in the spring itself. A small correction must be added for the paper in the case of light springs. The method is very convenient, and can be used for frequencies up to 150 per second, beyond which the springs become too stiff.

Electro-Magnetic Theory of Radiation—Professor M. Planck, of Berlin, published some months ago a derivation of the formula connecting energy and wavelength in the spectrum of a black body at a given temperature, the derivation being based upon the notion of an electrical resonator enclosed in a space surrounded by perfectly reflecting walls. It is remarkable that this formula should agree with the formula of Stefan obtained by thermodynamical considerations. In the *Verhandlungen d. Deutschen Phys. Gesellschaft*, for December, 1900, Professor Planck has given an outline of some work, soon to be published in full, says *Science*, in which he applies the method of probabilities to the determination of the partition of energy among a vast number of electrical resonators enclosed within a reflecting boundary. A consequence of the theory developed by Professor Planck, which gives some check upon its legitimacy, is a formula which permits the calculation of the number of actual molecules of any salt in a gramme-molecule (the number of atoms in a gramme of hydrogen), the basis of the calculation being the energy curve of the spectrum of a black body as determined by Lummer and Pringsheim and by Kurlbaum. It is thus found that an atom of hydrogen weighs 1.64×10^{-24} grammes. Professor Planck compares this result, together with other results depending upon it, with previous approximate determinations of this quantity, and he remarks that the values determined by his formula are not approximations, but that the calculations are absolutely valid, provided that his theory is true.

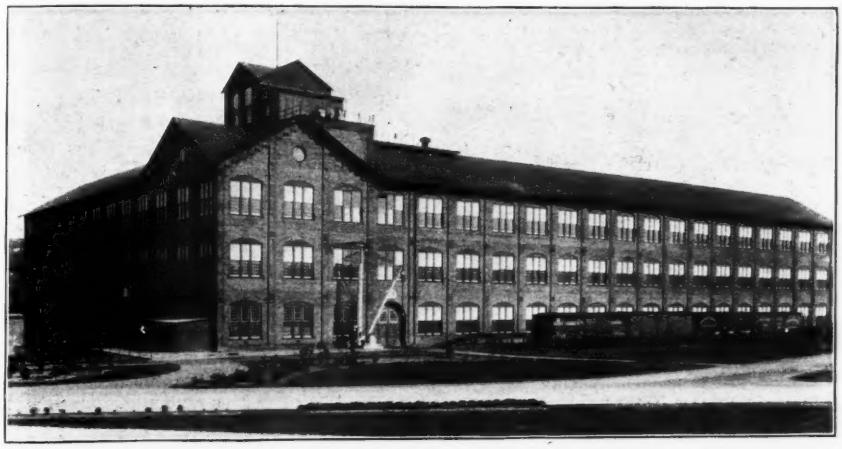
Samarium Carbide—M. H. Moissan recently presented before the French Academy the results of his study of this substance. It was prepared by mixing 200 grammes of samarium oxide ($Sa_2\ 0_3$) with 20 grammes of sugar charcoal, the whole being powdered finely and then compacted by pressure. This mixture was heated in the electric furnace for four minutes with a current of 900 amperes at 45 volts, and resulted in a lump of fused carbide weighing about 150 grammes. This substance is yellowish in color and its small particles are transparent. Its fracture is clearly hexagonal and its specific gravity about 5.86. In cold water the carbide decomposes like the metallic carbides of the same series and gives off liquid, solid and gaseous compounds in the following proportions: Acetylene, 70.1; carbon compounds of the ethylene series, 7.6; hydrogen and compounds of the formene series, 22.3.

Electric Waves in the Earth—M. E. la Grange has endeavored in a paper in the *Comptes Rendus* to throw light on the part played by the earth in the production of electric waves such as are used in space telegraphy. He believes that the earth behaves as a conductor and not as a dielectric. He buried a coherer in the ground one foot deep, at a distance of some 100 yards from a spark-gap provided with an air wire two metres in length. Before the coherer was covered up by earth it responded fairly well. When the wooden box containing the apparatus was covered with earth to the depth of one foot all action on the coherer ceased. From this the author concludes that the waves are partly absorbed and partly reflected by the soil, and he points out that the explosion of underground mines can not be carried out with the apparatus described.

The Schenectady Works of the General Electric Company—II.

The Largest and Most Complete Electrical Manufacturing Establishment in the World—Some Account of Men, Methods and Machines—A Representative American Industry.

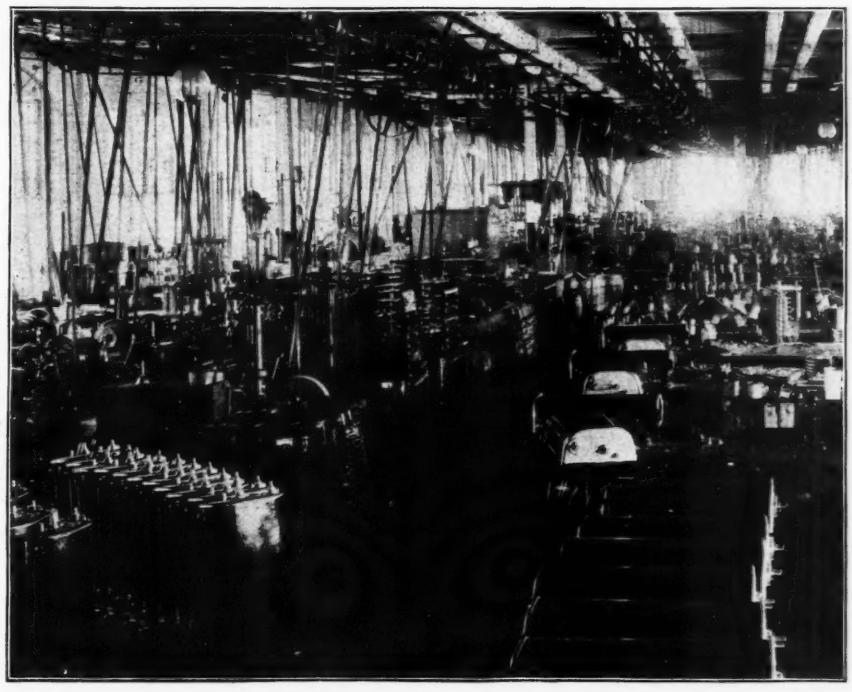
In the former article mention was made of the heavier mechanical processes employed in the construction of electrical machinery at the Schenectady shops. Of scarcely less interest is the lighter work, both that employed in building the smaller machinery and upon parts of the large apparatus, and the more purely electrical work, such as coil-making, winding and the insulation of wires.



BUILDING NO. 23 OF THE GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

Perhaps the best way to exhibit this branch of the company's work is by a brief description of the industries carried on in factory building No. 23, of which an illustration is here shown. It must be stated here, however, that since the taking of the photograph from which the illustration was made the building has been extended to the left of the front shown so that the tower is now at the middle of the front.

In this building is carried on the manufacture of switchboards, of controllers for street railway motors, of sockets and other small trimmings employing brass and porcelain, of most of the small parts such as binding-posts, screws, nuts and studs, and of searchlights. Probably the most striking feature of the work within the building is the very large use made of automatic machines, such as screw machines, turret lathes and other machine tools for the duplication of large numbers of small parts. The controller department is well illustrated in one of the engravings, which gives a general view of a portion of the floor upon which these machines are assembled. The evolution of the street railway controller has been one of the most remarkable in the history of electric applications. In it, in small compass, are gathered many switches which must control large currents and also means for the destruction of powerful arcs which may be formed when the currents are broken, together with interlocking and safety devices so that the mechanical operation of the controller is reduced to the simplest possible turning of two handles. Like all the rest of the company's product the controller has been standardized to the last degree, both in the method of its manufacture and as regards sizes and capacities.

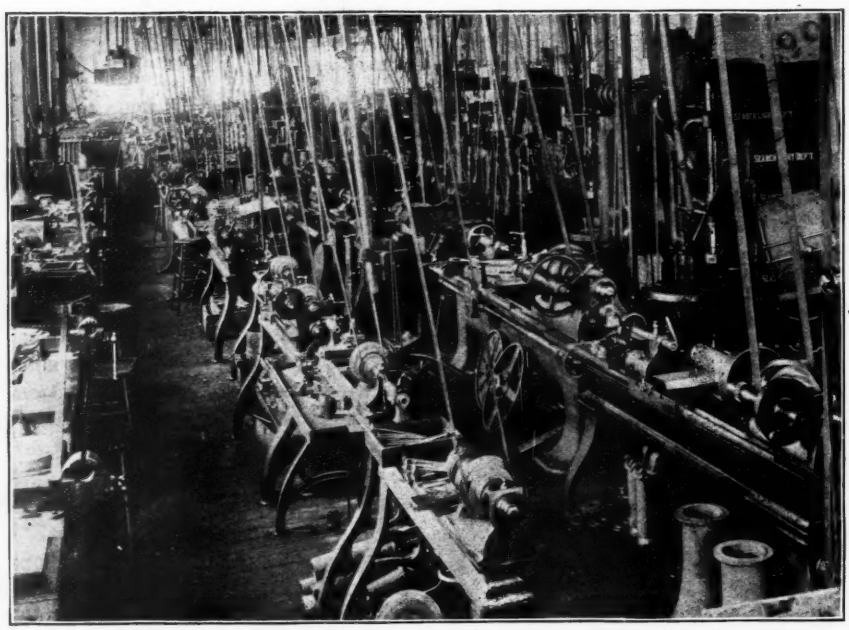


PART OF THE RAILWAY CONTROLLER DEPARTMENT OF THE SCHENECTADY WORKS.

The somewhat crowded illustration showing this floor can not, of course, exhibit the great detail of such work as is there conducted. The method of assembling and fitting the interior portion of the controller is exceedingly ingenious, resulting in the production of controller cylinders which are of standard size all over and making repair and replacement easy. Like other standard output, controllers and their parts are manufactured in great quantity and stored, either as parts or assembled, ready for quick shipment upon receipt of orders.

Another illustration shows a part of one of the small machine shops in this building. Several of these small shops, among them a well-equipped model-making plant, are in operation. A feature of the work in this building is the use of automatic and semi-automatic machines for the production of small parts. Upon turret lathes or upon their further development—

screw machines—a large proportion of the small round pieces, both of brass and steel, are made, the result being a remarkable equality of product as well as a considerable reduction of the labor cost upon each class of the pieces so construct-



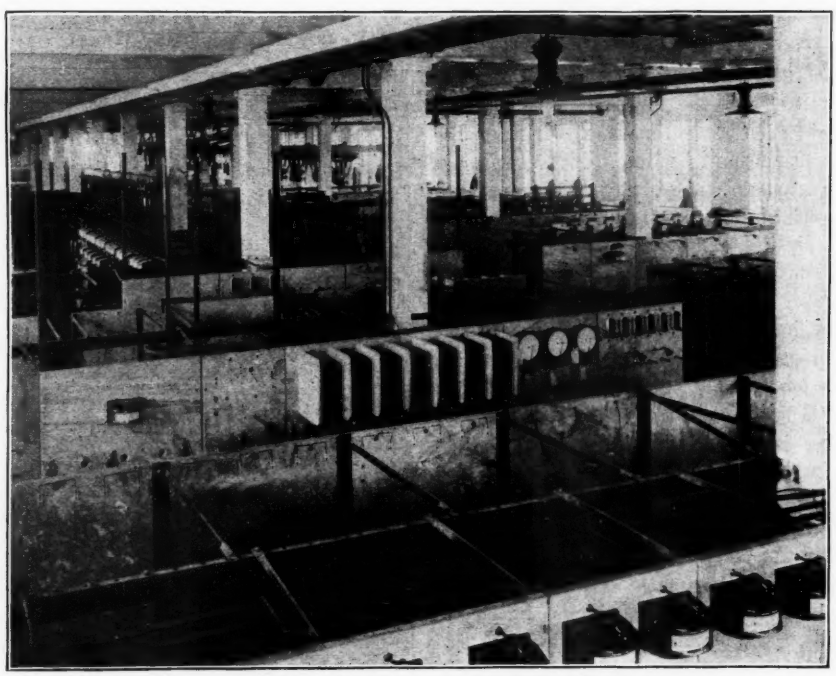
Small Lathes in Building No. 23, Schenectady Works.

ed. Indeed, the tendency toward automatic or semi-automatic methods is notable throughout the works of the General Electric Company. It has often been noted in the technical press that one of the widest differences between American and European methods of manufacture is in the increasing use of machine tools of an automatic character in this country and the corresponding decrease of the cost of labor necessary in the production of a given article. Of course, economies of this character can not be carried on except in places where a very large output is produced, but the conditions at the Schenectady shops are such that the fullest advantage of modern mechanical methods can be taken with the result not only of keeping down the cost of production but, as well, of producing product of highly standard quality.

A result of this policy of producing as nearly as possible absolutely standard parts may be seen in the view of another room in the same building, in which the assemblage of sockets, switches, cutouts and other small accessories is carried on. It will be noted that for this work women and boys are employed, their labor being confined, for the most part, to the assemblage of the pieces which simply require putting together in proper relation. There is, of course, no necessity for fitting or any hand work except that of the simplest character.

On the middle floor of building 23 is the searchlight department, which is highly interesting. Here are constructed searchlights and projecting lamps ranging from the smallest sizes up to the gigantic projectors manufactured for coast fortifications and large naval vessels. The tower shown in the illustration of building No. 23 is used for the testing of searchlights after their assemblage. For this purpose large targets painted white have been erected on hills distant about three miles from the building and here, at night, the lights are tested by expert operators who sweep the neighboring country with them and observe their power in "picking up" the distant targets. The value of a searchlight depends almost entirely upon the ability to find a distant object with it at night. After a long series of experiments in various weather conditions the operators of the searchlight testing department have become highly expert in judging the capacity of a projector for naval or coast defense purposes.

The interesting photograph shown herewith was taken on the railed platform from which the tests are made and represents the beam of a searchlight turned down toward the gate-house at the entrance to the company's grounds. The streak of light which appears in the beam of the searchlight is probably due to the sparking of a trolley wheel on a car which was passing at the time the photograph was made. In the same building is the department for the manufacture of switchboards. Here again the same remarks as to standardization apply to this manufacture, it having been reduced to very simple terms. The illustration gives a highly inadequate idea of the work being done in this department, for the reason that the switchboards hide one another and make it impossible to show the extent of the assembling room in which they are standing and at the same time exhibit any details of the individual boards. It is a case of the forest being invisible on account of the trees.



Switchboard Construction Department, General Electric Company's Shops.

The standard design for such boards consists of panels of marble or slate mounted in structural iron frames such as are shown in the foreground of the illustration. Panels for the control of dynamos and for feeder circuits for lighting or railway purposes, as well as the more complicated panels intended for the control of polyphase feeder lines and machines, have been reduced to a comparatively small number of standard designs and the grouping of these gives the average type of switchboard turned out by the company. It may be mentioned that all of the work upon the boards, including the manufacture of the appliances installed upon them, is carried on in these shops with the exception of the construction of certain types of instruments, which are made at the company's factory in Lynn, Mass.

ASSEMBLING SOCKETS, SWITCHES AND FUSE BLOCKS AT THE GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

No small part of the work of the company consists in the forming of wire into the various shapes requisite in finished machines. Copper wire is received at the works as it comes from the drawing mills, and undergoes all the subsequent processes fitting it for use in the finished apparatus in various departments of the works. In the full-page illustration are shown four views of the wire-covering and cabling machinery in building No. 14, a structure 72 by 402 feet in size and two stories high. On the ground floor of this building are machines for covering wire with rubber and compounds, these being of the usual type employed for that purpose. Here, also, are found the lead presses for covering cables and other conductors with a sheathing of lead. Their operation is similar to that of the machines used for making lead pipe, the lead being forced, while hot, by hydraulic pressure around the core. Upon the same floor are a large number of cabling machines, one of which is shown in the illustration, for laying the strands of wire composing cables and for taping and otherwise insulating these after their construction. In this department cables are made ranging in size from the delicate-stranded conductors used in ordinary lamp cord up to heavy feeder cables of the largest section.

On the upper floor of the same building are to be found a large number of wire-covering machines which are well shown in the illustrations. Here the various sizes of magnet wire are covered, and the vast consumption of this product necessary in the works may best be judged by a glance at the illustrations showing the machines in use for the purpose.

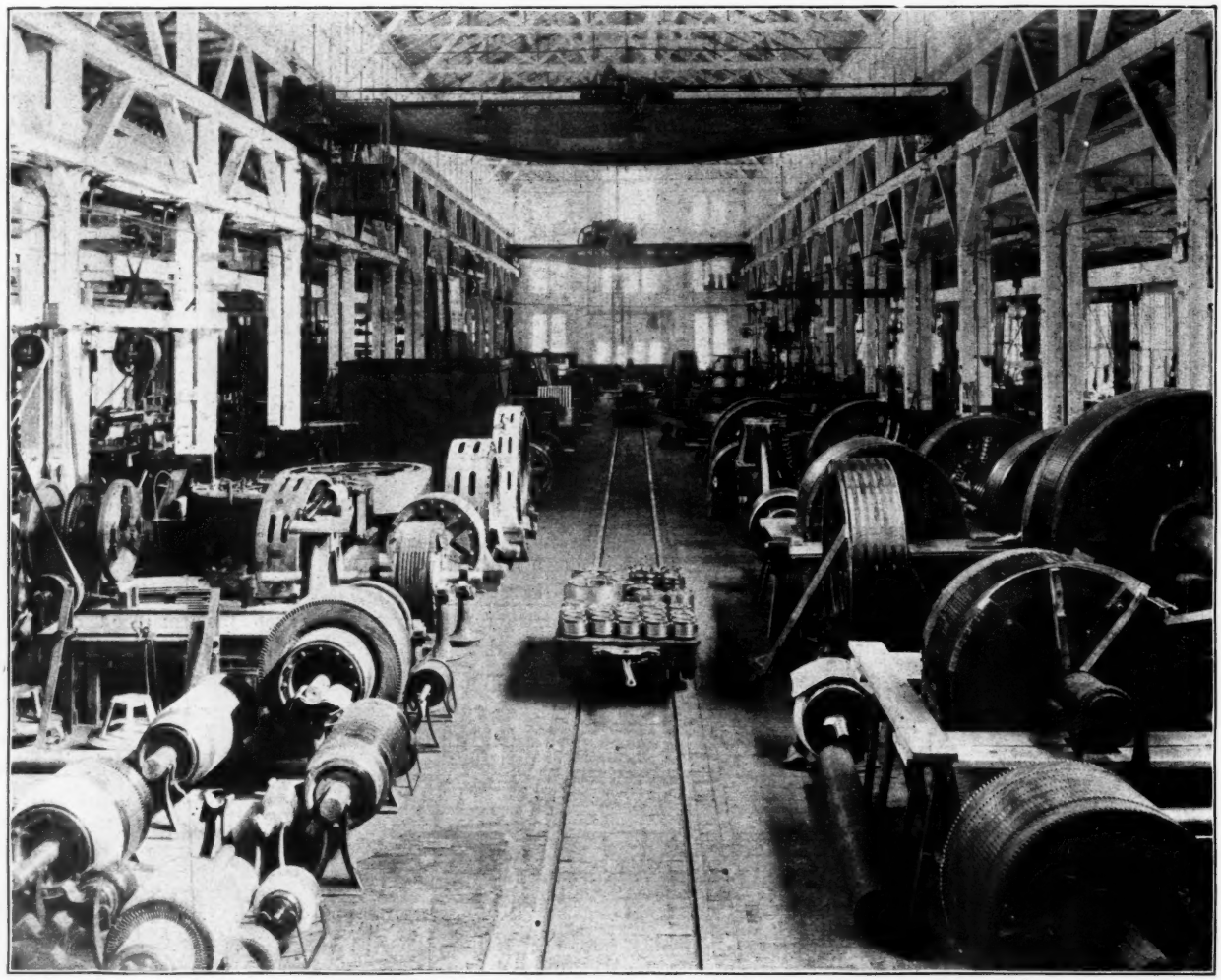
Passing now for a moment back to the machine shops the armature department is of great interest. A view of the aisle in this department is shown in one of the illustrations. Here the finished cores, received after the parts composing them are assembled in the large machine shop, are wound.

TRYING A SEARCHLIGHT AT THE SCHENECTADY WORKS.

The term "winding" in the modern sense means really the application of formed coils to a core prepared to receive

them. Winding in the old sense, in which wire directly from the reel was applied by hand to the body of an armature, is no longer practised in the works except in rare cases where some obsolete armature is repaired. All of the work of applying conductors to modern armatures is now done through the agency of the machine-formed and thoroughly insulated coils. A brief description of the manufacture of these coils appeared in the former article.

Much use is made, in the larger machines turned out by the company, of a winding consisting of copper bar or strip wound on edge. In the case of the field coils of a revolving-field alternator, for example, where the total applied pressure from the exciter is not more than 125 volts and where large numbers of coils are used in series, the potential difference between the adjacent spires of these coils is an almost negligible quantity. For such coils the edgewise strip windings have been found of the highest value, because they are comparatively easy to manufacture and, while allowing the largest amount of conductor to be crowded into the smallest possible space, still give excellent opportunities for the radiation of heat and are exceedingly strong mechanically. For the purpose of making such winding there have been evolved in the shops machines which rapidly turn out coils of any desired section or shape. The insulation of such coils is a matter of extreme simplicity, a thin fibre paper being used between adjacent spires.

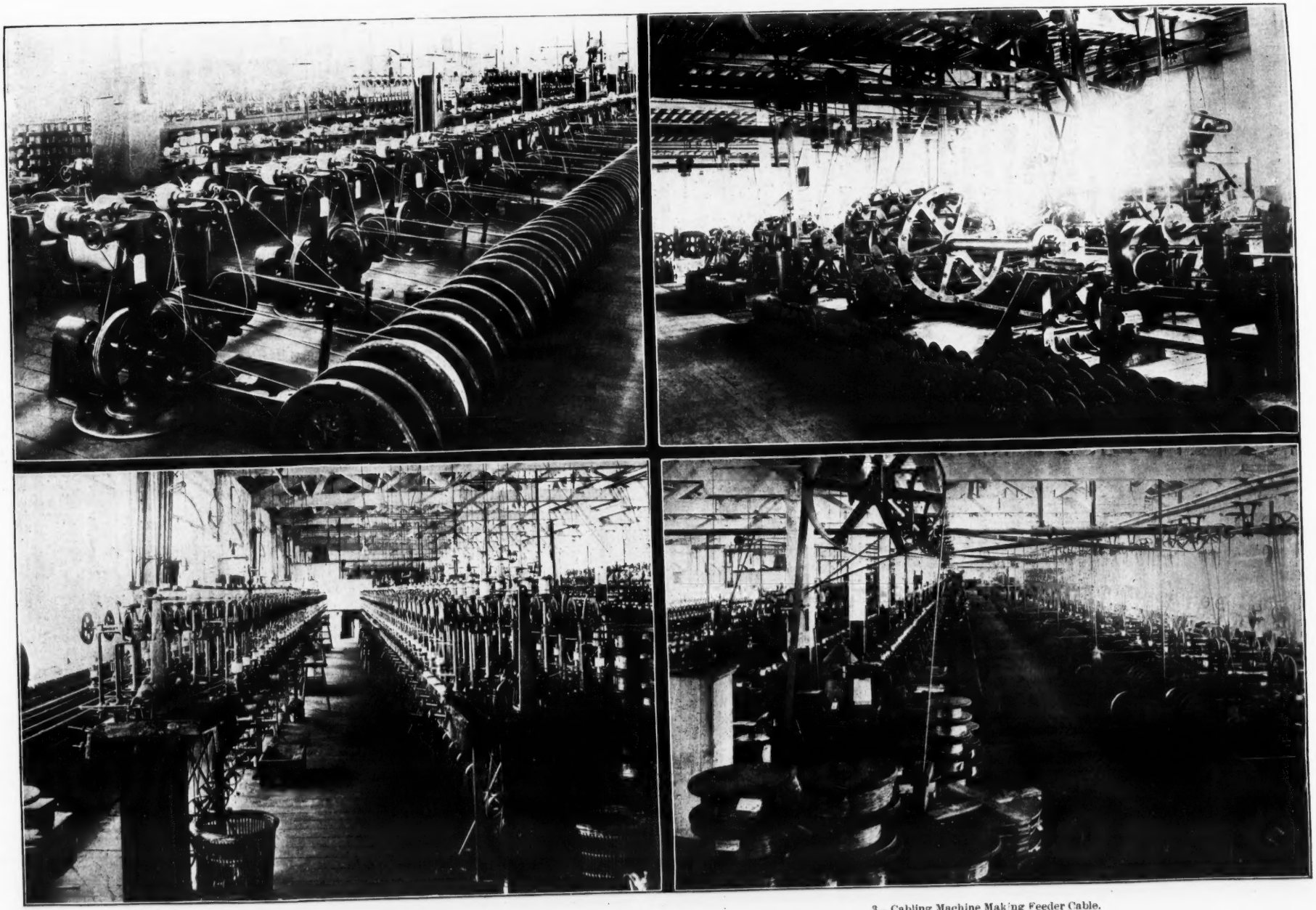


One of the Aisles of the General Electric Company's Armature Department.

Considerable quantities of copper bar are also used in the windings of the larger machines, and this is insulated generally by means of tape applied by a revolving shuttle of great simplicity and subsequently treated with insulating varnishes and other compounds.

In the gallery of the great machine shop building are located two departments of much interest—mica working and commutator building. Very large quantities of mica are used in modern electrical machinery, the peculiar qualities of this material having given it a unique place among insulators. In the mica department the crude mineral is received in slabs and sheets, many of them coming in their original casings from the mines in India, and is separated and afterward consolidated by the well-known process employing varnish to fasten separate sheets together and then compacting the whole under heat and great pressure. By the use of appropriate moulds small sheets of mica may be applied to surfaces of almost any desired shape and firmly compacted into a material possessing extraordinary qualities of resistance, dielectric strength and mechanical strength. For example, the beveled rings used in commutators of all sizes are here constructed in this way, as well as many mica pieces of complex shapes for various applications. A great quantity of sheet mica-board is also built up for use in the insulation of large apparatus. So perfect is the economy of this department that practically none of the valuable mica is lost, the scrap of the larger pieces being worked up by the compacting method into smaller shapes.

At the other end of the same gallery is situated the commutator department in which all of the commutators used in the company's output are assembled and fin-



1.—Magnet Wire Covering Machines.
2.—Silk Wire Covering Machines.
3.—Cabling Machine Making Feeder Cable.
4.—General View in Wire Insulating Works.

SOME VIEWS IN THE COVERING AND CABLE-MAKING DEPARTMENT OF THE GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

ished, except those of very large size which receive their final finishing on one of the great boring mills on the main floor of shop No. 16. The process for constructing commutators in general use by the company is very simple and direct. The material used in all of them is hard-drawn, tapered copper bar which is received in long pieces from the maker. These bars are cut up into appropriate lengths, and the pieces assembled with their mica insulation in contracting rings. When set up in these rings the whole structure is chucked in a lathe and practically all of the finishing work upon it, such as shaping the ends of the bars to the proper bevel and turning off the cylindrical structure inside and out, is done in the lathe. By the use of what is practically a turret lathe, small commutators can be turned out with great perfection of size and are, of course, standard in all respects. Naturally, the valuable scrap copper resulting from the turning and other machine processes in this department is carefully saved, as is scrap material of all kinds in general throughout the works.

This chapter, concerning the smaller industries of this great establishment, would be incomplete without reference to the porcelain factory. It was found desirable some years ago that the company should manufacture its own porcelain and a shop was erected for the purpose. This having been outgrown a new porcelain shop has recently been built (not shown on the map on page 334). In this large building are found the grinding mills, pug mills, presses, drying racks, kilns and other accessories used in the manufacture of porcelain, and here will be made all of this material used by the company in the manufacture of fittings, switches, sockets and insulators in the future.

Electrical Exhibitors at the Pan-American Exposition.

Below will be found a list, to date, of the exhibitors in the electrical section of the Pan-American Exposition, to be held at Buffalo, N. Y., from May 1 to November 1, 1901. The list includes all exhibitors in the electrical section as well as those who are installing their apparatus about the grounds for service purposes. The exposition authorities expect additions to the list until the middle of April. The names of exhibitors are as follows:

American Electric Telephone Company, Chicago, Ill.
American Vitrified Conduit Company, New York, N. Y.
Arnold, B. J., Chicago, Ill.
Bossert Electric Construction Company, Utica, N. Y.
Bettini Phonograph Company, New York, N. Y.
Bullock Electric Manufacturing Company, Cincinnati, Ohio.
B. & E. Hanfield, New York, N. Y.
Bernard Company, E. G., Troy, N. Y.
Camp Company, H. V., Akron, Ohio.
Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
Clark Automatic Telephone Switchboard Company, Providence, R. I.
Crocker-Wheeler Company, Ampere, N. J.
D'Olier Engineering Company, Philadelphia, Pa.
Electric Storage Battery Company, Philadelphia, Pa.
Edison Manufacturing Company, Orange, N. J.
Eureka Electric Company, Chicago, Ill.
General Electric Company, Schenectady, N. Y.
Gould Storage Battery Company, Depew, N. Y.
Holland, C. C., New York, N. Y.
Incandescent Electric Light Manipulator Company, Boston, Mass.
Jandus Electric Company, Cleveland, Ohio.
Kellogg Switchboard and Supply Company, Chicago, Ill.
Keystone Electric Company, Erie, Pa.
Lea Manufacturing Company, Elwood, Ind.
Morris Electric Company, New York, N. Y.
Miller Signal Company, Chicago, Ill.
Mason Monogram Company, New York, N. Y.
National Gramaphone Company, New York, N. Y.
National Carbon Company, Cleveland, Ohio.
National Automatic Telephone Company, Chicago, Ill.
Northern Electric Manufacturing Company, Madison, Wis.
Onondaga Dynamo Company, Syracuse, N. Y.
Phelps Company, Elmwood, Ill.
Peru Electric and Manufacturing Company, Peru, Ind.
Power Installation Company, Buffalo, N. Y.
Rowell, C. B., Dr., Buffalo, N. Y.
Syracuse Electric Fuse Company, Syracuse, N. Y.
Stromberg-Carlson Telephone Manufacturing Company, Chicago, Ill.
Stanley Instrument Company, Great Barrington, Mass.
Stanley Electric Manufacturing Company, Pittsfield, Mass.
Safety Insulated Wire and Cable Company, New York, N. Y.
Toerring, C. J., Philadelphia, Pa.
Wagner & Company, R. W., Chicago, Ill.
Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.
Waite & Bartlett Manufacturing Company, New York, N. Y.
White Company, O. C., Worcester, Mass.

Reports from England state that in December of last year the Corporation of Tunbridge Wells inaugurated the first system of municipal telephones in the United Kingdom at a cost of $50,000, providing service not only for the town itself but for subscribers within a radius of 10 miles. At present the Corporation has 400 subscribers and the town guarantees to provide a rate of $15 per year.

Windmills and Electricity.

Windmills, except in Holland, have almost entirely gone out of favor for their original purpose, namely, that of grinding corn, and are indeed but sparsely used even for pumping water. They may, however, be more largely patronized in the future. It has been suggested that they might be employed in the production of electricity, and experiments having this for their object have just been made at Wittkiel, a little German village near Kappeln, on the picturesque banks of the Schlei, not far from Hamburg, and at the entrance to the bay of Kappeln, on the Baltic, says the *Tramway World.* A special windmill to test the new idea has been constructed by Herr C. P. Neumann, of Wittkiel. This has a diameter of 39 feet, with a wind surface of 326 square feet. It can develop 30 horse-power, with a speed of 10 revolutions a minute. It drives a dynamo which, running at a speed of 700 revolutions, furnishes a current of 120 amperes at 160 volts. The electrical output attains its normal value when the speed of the wind exceeds nine feet per second. The dynamo is also employed to charge the accumulators, which furnish a current of 110 volts used in lighting the town and in driving several small motors. The experiment having proved extremely satisfactory, a larger installation comprising several windmills and dynamos is under consideration, and we may again possibly see the mill forming a prominent feature of our own landscapes as in former years, though its purpose may be slightly different.

The Import Trade of the Argentine Republic.

An authority on foreign and domestic commerce states that the total import trade of Argentina for the first nine months of 1900 was $87,000,000 in value. The share of the United States (a trifle over $9,000,000) was exceeded by that of Italy, which nearly reached $12,000,000. Our most formidable competitor is shown to be the United Kingdom, which sold the Argentine Republic during the same time goods to the amount of over $30,000,000. Germany also made a better record than the United States, her share having amounted to nearly $13,000,000.

A significant fact is that as compared with the record for the corresponding period of the preceding year the export trade of the United States to Argentina fell off $1,500,000 and that of Great Britain $2,600,000, while that of Germany increased $2,500,000, and of Italy, $1,000,000.

These figures show that Germany's well-directed efforts to forge ahead in the markets of South America are bearing fruit. Italy's favorable showing is probably due to the immigration of Italians into Argentina.

Recent Electrical Patents

A new method of insulating wire and a new insulation as a result thereof, has been patented by Charles P. Steinmetz, of Schenectady, N. Y., who has assigned his interest in the same to the General Electric Company. While the invention finds a large field of application, it is especially useful in connection with the fine wire used in the construction of electrical measuring instruments and the like, and renders it possible to cover the wire with a very thin coating of insulating non-inflammable material. In carrying out the invention, the wire is first passed through a solution of cellulose made by dissolving the cellulose, preferably in the form of cotton-wool, in an ammoniacal solution of cupric oxide. This reagent is best prepared by first precipitating with caustic soda a solution of sulphate of copper to which sal ammoniac has been added, preserving the precipitate under water, and when the reagent is needed adding the hydrated cupric oxide to ammonia, so long as it dissolves. The solution of the cellulose in the cupric ammonia produces a deep-blue mucilaginous liquid. After the wire has been passed through this solution it is allowed to dry and then passed through diluted hydrochloric acid in the proportion of one part of acid, by weight, to five parts of water, and is afterward thoroughly washed with pure water and dried. The dilute acid dissolves out the cupric ammonia and leaves the cellulose upon the wire in the form of a horny brownish-gray structureless coating. With larger wire or thicker films of cellulose the coating may, if desired, be impregnated with linseed-oil or some other similar substance to increase its toughness and flexibility.

A novelty in the line of electric incandescent lights, designed for use in telephone switchboards, has been patented by John W. Howell, of Newark, N. J. The patent has been assigned to the General Electric Company. As is well known, the lamps ordinarily used are extremely minute, and are of such a character that they are very easily broken. At the same time, a high degree of skill is required in their construction, so that they are exceedingly expensive, costing several times as much as standard lamps of 16 candle-power. The present invention is designed to overcome these objections. Broadly, the invention consists of the usual bulb having the arched filament and platinum lead-in wires. Arranged upon the opposite sides of the lamp and longitudinally thereof, are contact-plates, to which the lead-in wires are soldered. These contact-plates extend nearly the entire length of the lamp and project below the bases thereof to form the terminals which are insulated from each other, and may be protected by wrappings of fabric, so that should they be brought together, they will still be sufficiently insulated. Suitable bases may be interposed between these terminals if desired. By this construction the lamp is entirely protected between the metallic strips, and is comparatively inexpensive to manufacture.

INCANDESCENT LAMP FOR TELEPHONE SWITCHBOARDS.

An Englishman, Mr. Adolf Vogt, of Westminster, England, has discovered a novel method of manufacturing electric heating appliances, and has obtained a patent in this country on the same, which is controlled by the Electric Resistance and Heating Company, Limited, of London, England. An abstract of the patent follows:

This invention relates to a manufacture of electric heating appliances of high electrical resistance which shall be capable of producing and sustaining very high temperatures during long-continued use and which are mainly composed of a mixture of a non-conducting substance and a metal conductor. As non-conductor there may be used for this purpose kaolin, alumina, talc, quartz, and the like, also all very difficultly reducible or fusible metal oxides, such as aluminum oxide and the so-called "rare earths," the essential characteristic of the material employed, or of some part thereof, being that when heated to a high degree it shall become fritted, slagged, or more or less vitrified, so as to form a hard, dense body. The metals employed as the conducting material are nickel, cobalt, wolfram, and the like. For forming the heating bodies of a mixture of such materials it is indispensably necessary to first reduce them to an exceedingly fine state of subdivision and then to mix them intimately together and form the mixture into a paste or dough by the addition of water or other liquid. From this dough, which can be worked like potters' clay, the heating bodies can be molded of any desired configuration or the plastic compound can be pressed in molds, such pressure being only effected in order to insure perfectly uniform dimensions when the heating bodies are to be manufactured on a large scale. After molding, the heating bodies are dried, and they are then heated in an atmosphere of hydrogen gas, at first only to such a temperature that the more or less oxidized metal particles shall be completely reduced. For example, when nickel is used as the metal the temperature would be about 400 degrees centigrade. When such reduction of the more or less oxidized metal has been completely effected by this means (such oxidation will mainly occur on the surface of the particles), the mass while still surrounded by hydrogen gas is heated to so high a degree that it becomes fritted or slagged—that is to say, more or less vitrified—forming a dense, hard body. The temperature employed should about equal the welding heat of the metal constituent, but should not exceed this.

In the above process special care has to be taken that the metal is kept as free as possible from contact with carbon, as otherwise the bodies produced when subject to frequent use are liable to become of increased resistance, the metal becoming brittle and of reduced conducting power.

The subjecting the resistance bodies first to a comparatively low temperature in an atmosphere of hydrogen and then to a high temperature while still surrounded by hydrogen instead of subjecting them at once to a high temperature while surrounded by carbon powder, as was heretofore done, constitutes the essential and important feature of the present invention, inasmuch as the metal employed being unavoidably more or less oxidized it is necessary to effect its complete reduction by means of the hydrogen gas before the non-conducting constituent has been made to assume the dense fritted or vitrified condition by the application of a high heat, as if the still-oxidized particles become reduced, and consequently shrink in volume, after the non-conducting constituent has assumed the said hard condition this can no longer shrink to a corresponding extent, and as a consequence the metal particles would not be in such relative positions in the mass as would enable them to afford the requisite conducting power for giving the body the exact degree of resistance required—that is to say, the resistance would be too high and unreliable, and consequently the body practically useless.

Book Review

"Yawps." By William J. Lampton. Henry Altemus Company, Philadelphia.

Mr. Lampton's first collection of poems is perhaps best characterized by the statement printed on the title page of the book, in which the author says: "Merely a simple yawpist yawping his yawp of things as they are and not what they seem." The book is dedicated somewhat facetiously to the late Charles A. Dana, a gentleman who is described as one who knew a good thing when he saw it and printed it. While Mr. Lampton does not claim to be a poet pure and simple he may well be considered to have made popular a new school of verse which has been adopted by many other newspaper paragraphers throughout the country on account of its originality, the freedom of diction which it permits and its adaptivity to any subject. Among the verses is one entitled "The Electric Fan," which was reprinted in the ELECTRICAL REVIEW some time ago.

Automobiles

A total of 170 automobiles are at present in use in the city of Brussels, Belgium, while throughout the country there are altogether 1,090.

One of the attractions announced for the July meeting of the Gentlemen's Driving Club at Monmouth Park, N. J., is a $5,000 25-mile automobile race. A five-mile race is also announced.

Reports from Dawson City, Yukon Territory, state that so far the automobile stage line which was recently opened for business between Dawson City and Grand Forks has been quite successful, the trips having been made on schedule and in good time.

Selling "things" on the instalment plan has long been a popular method of doing business and the automobile is the last machine to be exploited on those terms, a large department store in New York having recently offered carriages on "easy payment" terms.

One of the representatives in Spain of Emilio Aguinaldo, the Filipino insurgent leader, whose name is Dr. Canon, says that so far as he knows automobilism will be an important feature in the Philippines and advises manufacturers and importers to make an effort to secure the trade at once.

The coming show of the Automobile Club of England, in the Agricultural Hall of London, is said to be on the high road to success, as more than 100 firms already have contracted for space. Rumor has it that another automobile show will be held at the Crystal Palace somewhat later under the auspices of the Motor-Car Club.

Emperor William's $10,000 prize for a road race between the automobile clubs of France and Germany has occasioned considerable comment, and the race will be held June 25 for the touring class and June 27 for the racing vehicles. The course is between Paris and Berlin, and stops will be made at Aachen and Hanover.

A "cart automobile" has been recently invented in Chicago and is a curious structure, being mounted on two wheels, which are six feet three inches in diameter. The vehicle weighs 2,100 pounds, and each wheel has 48 three-eighths-inch steel spokes centred in a three-inch hub, which conceals a motor. The battery hangs below the axle, weighing 300 pounds, and prevents the carriage from turning over. When the power is turned on the seat tilts back with the driver and at the same time prevents oscillating.

Assemblyman Doughty, of New York, who some time ago prepared a speed-regulation bill for automobiles is now drafting another and will let the first measure "die in committee." By the terms of the new statute automobiles may run at a speed of eight miles an hour in cities and 15 miles in the country. This latter draft is known as a "substitute bill."

Mr. Justice Buffington, of the United States District Court, recently authorized the receivers of the Baldwin Automobile Manufacturing Company to issue certificates (in the denomination of $500 each) to the amount of $12,500, which will be used for operating the plant and will be held as first liens against the property, with the exception of a mortgage and wages due to workmen before the commencement of the bankruptcy proceedings, and all reasonable and necessary expenses.

Recent reports from Hartford, Ct., tell of the endurance of a four-horse-power automobile, which covered 438 miles in a race, the temperature being part of the time 12 degrees below zero. At one stage of the route the wind blew at the rate of 40 miles an hour and on the morning of the first day there was a heavy snow-fall. The time for the run was 41 hours, which could have been reduced by six hours had it not been that the drivers were compelled to get out and walk beside the vehicles to keep them from freezing, several of them being badly frost-bitten.

The Long Island Automobile Club, of Brooklyn, N. Y., is mailing descriptive matter of the conditions imposed for the 100-mile endurance test to be held over Long Island roads at a date soon to be decided upon. The matter of classes, speed limit (maximum 15 miles per hour), time limit (12½ hours), operation, course, supplies and battery relays, character of untimed stops, awards and rules governing timekeepers are given particular attention. The notice to operators regarding the test states that vehicles must be ready to start promptly at 9 A. M., and will be classified according to motive power, starting at intervals of 30 seconds. The usual "rules of the road" are to be followed and it is expected that no confusion will result.

French people have a very curious idea of humor. Here is a literal translation of an article which appeared in the reading columns of one of our esteemed contemporaries: One day while he conducted his automobile upon a road in the suburbs of London, he perceived coming toward him a phaeton conducted by a gentleman of the most elegant. From afar he saw that one lift up his hand and thinking that the horses had fear, M. Hissey stopped himself suddenly, but when he saw that one was arrived to his place and when he saw himself that they were tranquil, he demanded very politely of the conductor why he to him had made a sign to stop himself, and one can figure to himself his surprise when he was answered: "Simply for you to tell that you are an imbecile to conduct one of those dirty machines." We fail to see the point of the joke.

At a recent meeting of the National Capital Automobile Club, held in the office of General Miles, in the War Department Building, at Washington, D. C., officers were elected. General Miles was made president; Messrs. F. C. Stevens, Congressman J. C. Sibley and C. F. Noment, vice-presidents; W. J. Foss, secretary, and Dr. J. A. Aspinwall, treasurer. It is stated that Lieutenant Ward, of the navy, will be elected one of the vice-presidents at the next meeting of the club, which is said to be starting out auspiciously, and the membership comprises some of the most prominent men in Washington, who believe they will be able to correct a number of abuses to which they and their fellow *chauffeurs* are now subjected. Until the selection of suitable quarters the meetings will continue to be held in General Miles's office.

South Carolina's legislators have fixed up the following regulations, which will leave the automobilist little chance to enjoy the sport in cities of that state. In commenting upon the measure an automobile journal says: "Fancy an automobilist arguing with a local magistrate what does and what does not constitute reckless driving of mules and automobiles. South Carolina lawmakers are either a lazy sort or have great faith in the prudence and equity of their constituents' ability to administer the laws."

"Section 1—Be it enacted by the General Assembly of the state of South Carolina: That from and after the approval of this act it shall be unlawful for any person to ride or drive any horse or mule or bicycle or locomobile or automobile upon any street or alley in any city or town or highway of this state in a wilfully careless and reckless manner.

"Section 2—Any person convicted of violation of the foregoing section shall be punished by fine not exceeding $100, or by punishment not exceeding 30 days."

THE RADIOACTIVITY OF MATTER.*

BY HENRI BECQUEREL.

At the commencement of the year 1896, in carrying out some experiments with the salts of uranium, the exceptional optical properties of which I had been studying for some time, I observed that these salts emitted an invisible radiation, which traversed metals and bodies opaque to light as well as glass and other transparent substances. This radiation impressed a photographic plate and discharged from a distance electrified bodies—properties giving two methods for studying the new rays. The phenomenon does not appear to be influenced by any known external cause, such as a variation of temperature, or a luminous excitation; it is entirely different from phosphorescence; is not weakened in an appreciable manner by time, even at the end of several years; and is emitted spontaneously without any apparent exciting cause. The radiating property appeared, firstly, to be bound up with the presence of the chemical element uranium; the metal discharges electrified bodies three to four times faster than its salts.

If some fragments of uranium or of one of its salts are placed upon a photographic plate wrapped in black paper, or covered by an aluminum leaf, and if between the uranium and the plate various substances are interposed, there is obtained at the end of several hours or days radiographs showing that the radiation is propagated in straight lines, and traverses different bodies unequally. In the radiographs the edges of the plates of glass, or of thin plates of other substances, throw a sort of shadow, which is still unexplained. This phenomenon, as well as an inequality obtained twice accidently through parallel and crossed tourmalines, led to the belief at the commencement of these researches that these rays had properties in common with light. But all the later experiments have shown that the new radiation undergoes neither reflection, refraction nor polarization.

It is shown by experiment that it is sufficient to arrange between the polar pieces of an electromagnet a horizontal photographic plate upon which is placed, in the centre of a little leaden dish, the radiating source of very small diameter. The rays emanating normally to the plate and brought back orthogonally on it are the most efficacious; the impression, large and diffuse, is thrown on one side of the field, and constitutes a sort of spectrum which is sufficiently pure. If one works in the dark, and places on the photographic plate bands of various substances, aluminum leaf, copper and platinum foil, etc., it is seen that under the screens the impression of the deviated rays is limited by elliptic arcs, distinguished from each other. Each screen arrests different radiations, the most deviated being the most absorbable. The dimensions of the elliptic arcs are in accordance with theory. The absorption is the same in air and in an absolute vacuum. These experiments constitute a sort of magnetic spectrum analysis of the deviable radiation.

The identification of this radiation with the cathode rays requires two other verifications—the demonstration of the existence of a transport of electric charges and that of a deviation in an electrostatic field. M. and Mme. Curie have made the first verification, and I have realized the second. M. and Mme. Curie placed a screen, isolated from all contact with the air, in connection with an electrometer, and observed that the radium radiation charged this screen negatively, whilst the source itself, if it is properly isolated, is charged positively. The current for each square centimetre of radiating surface was about 4.10^{-13} electromagnetic centimetre-gramme second units.

For my part, I showed that in an electric field the radiation of radium undergoes a parabolic inflection in the contrary sense to the field, as would be the case with a flux of negatively charged particles. The comparison of the electrostatic and magnetic deviations allows of the determination, like that of Professor J. J. Thomson for the cathode rays, of the velocity of the particles. For the particular radiations defined by $H\rho = 1{,}600$, the velocity has been found equal to 1.6×10^{10}—about one-half of that of light. The ratio of the material masses carried off to the charges which they transport has been found equal to 10^{-7}, a number identical with that corresponding to the cathode rays. From these numbers, and that which results from the experiment of M. and Mme. Curie, it follows that for each square centimetre of surface of the radiating substance studied there escapes a flux of material which would amount to a loss of about one milligramme in one thousand million years. If the material emission, which appears to be of the same order as the evaporation of certain scented substances, is the first cause of the observed phenomena, there would be no contradiction between the apparent absence of any source of energy and the continuous emission of this energy.

The most deviable portions of the radium radiation pass easily through all bodies when they are very near the source, but are stopped when these bodies are some centimetres distant. I have further recognized that, after having traversed a screen, the radiation possesses the same magnetic deviability.

I can only give here the physical properties of radioactivity. One of the most important applications has been the discovery, by M. and Mme. Curie, of new chemical elements. Radium has a high atomic weight, and a characteristic spectrum observed by M. Demarçay. Polonium, according to recent researches, has a spectrum in the ultra-violet. These bodies possess, then, the characters of simple substances.

Recent studies on induced radioactivity appear to open still new horizons. It has been mentioned already that a body becomes temporarily active when it receives the radiation of an active body. M. and Mme. Curie and M. Giesel have recognized that the induced activity thus provoked was much greater if the body was mixed in solution with an active salt and then afterwards separated by precipitation. In thus rendering barium active with actinium, M. Debierne has recognized that the active barium behaves as a different body from ordinary barium, that it could be separated chemically and concentrated. Active barium thus resembles radium. It differs from it by the absence of a peculiar emission spectrum and by the fact that its activity weakens with time. I would add that recently Sir W. Crookes, who has made numerous experiments by the photographic method, announced that he had prepared uranium that was almost inactive. According to these experiments, as well as those of M. Debierne, M. Geisel and myself, it would appear to follow that the activity of uranium is due in great part, if not altogether, to a small quantity of actinium or of another radioactive body.

These facts, although increasing the complexity of radioactivity from the chemical point of view, do not, however, remove from it its value; it can be remarked that if the existence of uranium as a simple body had been unknown up to the present, its radiant properties would have permitted of its isolation, even though they are not inseparable from its existence.

This short account shows that a new order of phenomena has arisen from the study of a new property of matter—radioactivity.

*From *Nature*.

A BRITISH VIEW OF AMERICAN METHODS.

[Correspondence of London Engineering.]

About five years ago I was working in Lancashire at my father's works, and being in the machine business could not but help continually learning of the Americans' ability to build and duplicate machines that were in ways superior to those built in Europe.

It occurred to me, therefore, to come over here to the United States to obtain a position in some good machine shop, and to have a practical understanding of how they run things here.

I have worked over here some time now in the tool rooms of various machine shops, and have noticed many differences, and one in particular—the eagerness to suggest ways and means over here. I also found quite a little to learn in the standardization and specializing of machines and parts.

Almost every nationality is represented in the shops here—from the New England Yankee to the Russian Jews and Italians. Harmony seems to be amongst them pretty well, and right here in the mixing of nationalities arises a benefit. Because out of these men's conglomerated ideas they must hit a good one, once in a while any way. And they have done, as has been seen.

Although the men are not "sassy" or as "independent as a hog on ice," they have sufficient confidence in themselves to "catch on" and work with a *vim*.

In my different positions I was in contact most of the time with a class of men who have done more than any other to give an impetus to American manufacturers—that is, I think, the toolmaker of America. If England could bodily "lift" these men from the states, every toolmaker that amounted to any thing, and put them to work in her own shops, they would have one of the hardest propositions that any competitor could wish for. Having these men would not, of course, be the whole thing, but it would go a long way.

Naturally arises the question, can an Englishman become as expert and scheme like the American toolmaker? Yes, he can and does so, right along. I have worked alongside Englishmen who could scheme and make tools in every way as good as the American born.

Maybe he could not scheme to the same extent when he was in England, because no one asked him to. But when he comes here, they not only ask him, but they do something more substantial still—they pay him for it.

I have asked many British-American machinists and toolmakers whether they would care to work in Great Britain again, and though these men were patriotic to England to the core, have in almost every case made some such expression as this:

"Not on your life would I care to work back there."

"Why, how is that?" I would say.

"Well, I tell you," they say, "If I were a wealthy man this country couldn't hold me a minute. I would live in England then, where art, literature, science, and honorable men would be my acquaintances. But I am not a wealthy man; I work by the week, and receive pay according to my ability; therefore I would much sooner live here. If my opportunities were as good in England, and my pay equal in purchasing power to what I receive here, then I would much rather live in England."

I know by my own experiences that a state of things exists in England that ought not to exist.

If a workman makes a suggestion in England, 99 cases out of a 100 he is ignored entirely. I, myself, have been amongst workmen in England, and in conversation with them have heard them say that they could see where improvements could be made to expedite the production of some particular part of a machine. On asking why they did not mention the matter to the foreman or manager they say:

"If I mentioned it to the foreman he would pretty well snub the idea, or give me no credit for it at all. And if I told the manager, the foreman would think I was after his job, and at the first opportunity discharge me; so I do not see any benefit for me."

Consequently, one of the most vital necessities that any nation, concern, or individual should have for success (originality) is not encouraged, but kept down.

That is why America has made such rapid strides in commerce; once she got started the American manufacturers have been able, and are able now, to use higher priced labor, to be a longer distance away from foreign, especially European markets, and still underbid their competitors. They may not have originated automatic machinery, jigs, gauges, the standardization of parts, etc., but they are able to see at once the great advantage to be got from their usage, and have the foresight and originality to apply labor-saving principles to any fresh department of manufactures they may take up.

The terms "cute and cunning Yankee" are wrong; he is not cute and cunning, but, to my mind, has an overpowering lust for the dollar, and commonsense.

When an American machinist or workman has an idea, the patent office is in easy access to his salary; the people are invariably glad to use some new idea, provided there is any little benefit in so doing, and not, as in England, pleased to find so many objections to an invention or scheme.

If an idea will only save cents, it has the attention of most every man in its particular department in the states. In England, if the self-same idea would be introduced, people to whom it was shown would say: "Well, it may save a copper or two, but it is not worth while bothering with." And so it is in many departments of English manufactures.

Detail is the keynote; if an American can see where a small saving may occur, a small improvement made in their manufactures, a better engraving or a more attractive way of putting their products before probable customers, any little scheme at all that will help, no matter whether it comes from a laborer, manager, or president, or whether it is an English, German, French, or Russian idea, it receives attention.

I had an idea for a certain labor-saving device. I made a sketch, and showed it to the manager of the firm I was with here in the United States of America, explained it to him, and he was interested and saw its feasibility, told me to make a model in his tool room, and see how it came out. I did as he said, it coming out satisfactorily. After which I made application for a patent, which, if granted to me, will benefit me considerably.

If the same proposition had been shown to a manager or foreman in England, it would very probably have been poohpoohed.

In England great individuals have been born with very fertile brains, men whose names will never die; but it is not policy to rely on a few men, but to encourage and not put down originality, let every man have his ideas considered, and make it worth while for the men to scheme and expedite things, and they will then maybe leave some of their narrow-mindedness and faith in trades unions as to output per man, etc.

I know plenty of English and Scotch mechanics in this country that would much rather live in Great Britain if they had a "show" of getting on the same as they have here; they would rather live under a government of clean politics, that gives law, justice, and a proper interest

to its citizens, such as England provides. In conclusion, any firm, corporation or nation which can produce per man a greater output than its competitors of articles of equal value, will have most certainly the more prosperous people.

Therefore, English manufacturers, take on with new schemes or suggestions, and expedite your manufacturing; maintain and, if possible, better your products, and cheapen cost.

Let men have your attention so as to get the most out of them, put in good labor-saving tools, use templates, gauges, jigs; have convenient and properly-built tools, have a systematic tool room, and specialize.

If an idea comes from a laborer, machinist, or president, if it is an American, German, or French proposition, provided it has merit, do not wait, but sail right in and use it. Be always on the lookout for new schemes, and ideas will evolve themselves. Advertise well and "pithy," use good illustrations and bring out the salient points of the machines or articles you produce, be it trivial or momentous. English manufacturers have the advantage of a fine geographical position, have a good and well-established business reputation, and can not be approached yet in some of their industries.

Therefore, do not get scared because you do not get orders for every quotation you submit. English manufacturers with the right kind of thought will always have a good living for themselves and the people dependent upon them.

H. HARRAP.

LEGAL NOTE.

The United States Circuit Court of Appeals for the Second District recently handed down two opinions invalidating claims 1 and 4 of the Thomson magnetic blow-out patent, No. 283,167, and claims 1 to 6 inclusive of the Thomson insulating shield patent, No. 401,085; and claims 1 to 4 inclusive of the Knight controller interlock patent, No. 428,169. The two latter of these patents were considered valid and infringed by the lower courts but the decisions on these two patents are reversed by the higher court, and this presumably settles the litigation upon them as the Circuit Court of Appeals is the highest tribunal in patent cases. The parties to the cases in the matter of the first two patents were the Thomson-Houston Electric Company *vs.* the Nassau Electric Company and the Lorain Steel Company; and the same company *vs.* the Bullock Electric Company and the Bullock Electric Manufacturing Company, *et al.* The parties to the case of the Knight patent were the Lorain Steel Company, appellant, *vs.* the Thomson-Houston Electric Company, appellee. Wallace, circuit judge.

Export Notes

Contracts aggregating in value nearly $90,000 have recently been received in New York from Mexico.

A complete electric light plant of moderate size was recently shipped to an engineering firm in Buenos Ayres, Argentine Republic.

Railroad material valued at considerably over $50,000 went to Buenos Ayres a few days ago, and it is believed will be followed by other orders equally important in the near future.

An electric railroad will soon be built between Castletownbere and Kenmare, Ireland, which will call for an expenditure of $3,500,000. Bids for the equipment will be called for early in April.

A large portion of the equipment for the Seoul, Korea, Electric Company's plant is coming from the United States, as our prices and deliveries are said to have been much more satisfactory to the local authorities than those stated in other tenders.

Exports from the port of New York for the first week of March were valued at $12,774,866 against $8,707,301 of the preceding week and $13,570,162 for the corresponding week in 1900. From January 1 the exports amounted to $95,079,288 against $104,475,329 for the same period of the preceding year.

Press despatches from St. Petersburg, Russia, state that the Minister of Ways and Communication will soon begin to make use of the credit granted him for the purchase of rolling stock for use on the state railways during the current year. It therefore behooves American manufacturers to investigate the matter and prepare tenders.

The total exports for the seven months ending with January, in 1899, 1900 and 1901, present the following figures: $7,746,089; $8,677,270; $4,105,388. These figures were compiled from a list of articles which showed a decrease. Among those showing an increase were scientific and electrical instruments, the figures for which are as follows: 1899, $20,172; 1900, $44,891; 1901, $45,355.

Contracts have been recently entered into by engineers in Queensland, Australia, with an American engineering firm for extensive electrical equipment for the erection of the new street railway workshops at Ipswich, Queensland. The equipment consists of four 250-horse-power boilers, three 1,500-kilowatt, 6,000-volt generators and five 500-kilowatt and one 1,000-kilowatt rotary converter sub-stations, which are for the Sydney tramways.

United States Consul Dillingham, writing from Auckland, New Zealand, states that for more than three years the local authorities have been discussing the advisability of introducing an electric tramway system in that island. Several contracts were granted to local firms and London syndicates but the change was not made. A New York company has now arranged to complete the road, and the material as well as the force of men to operate the line will be brought from America. The cost of the enterprise will be about $1,000,000.

Exports from the United States to Canada for the five months ending November 30, 1900, aggregated $38,105,096, and for the same period the British exports aggregated $9,345,856. The figures show an increase of nearly $6,000,000 from the United States as compared with the same period in 1899, although slightly less than $1,000,000 as compared with 1897. British exports show a decline of over $800,000 compared with the same period of 1899, and an increase of nearly $1,000,000 compared with 1898. The steel bars or rails for railways which were exported during the last five months ending November, 1900, amounted to $2,432,319.

The growing popularity of American products is illustrated by the following figures, which show the comparative rank of the various foreign countries in our export list. The United Kingdom, which in 1890 stood at the head of the list, still maintains that position, but shows an increase of less than 50 per cent. Germany has an increase of more than 100 per cent over the $35,000,000 in 1900 as compared with the preceding year. France, which stood third in 1890, is now fifth, while Canada, which was fourth in 1900, is now in third place. The Netherlands, which were sixth in 1890, are now fourth.

An interesting table was recently published by one of New York's daily papers giving a comparison of the exports from the United States during Cleveland's administration and the just-expired four years of Mr. McKinley. The figures are given below and are commented upon by the paper which presented them as being the good results derived from a protective tariff:

CLEVELAND YEARS.	
1893	$854,729,454
1894	807,312,116
1895	807,742,415
1896	986,830,080
McKINLEY YEARS.	
1897	$1,079,834,396
1898	1,233,564,828
1899	1,253,466,000
1900	1,453,013,659

Views, News and Interviews

If the invention recently put before the public really dispenses with the services of the telephone central operator, the subscriber whose choler is easily excited will have an excellent chance to curse himself.

It is reported that one of the large transoceanic steamship companies will install a number of electric windlasses on its piers in New York to replace the steam winches now used. The new windlasses will be employed to hoist out cargo and shift merchandise on the docks.

A Michigan paper recently said that: "The telephone company originally organized to fight the Bell company is now to be used by the Bell company to fight the company organized to do what the company organized to fight the Bell company did not do."

It has transpired that burglars recently stole a 400-pound steam boiler from a laundry in the "Windy City" and carted to a distant dwelling where it was found by detectives to be used for running a dynamo operating for experimental purposes. The boiler was taken from the laundry on a sled.

Early in the Spring the motormen and conductors of the Brooklyn, N. Y., Rapid Transit Company will put on their new khaki uniforms. The new livery will bear a marked resemblance to the uniforms worn by the United States troops in the Philippine Islands. Brown canvas hats will be worn to match the suits.

A Missouri editor who equipped his newspaper office with a few telephones some time ago to obtain rural news is said to-day to possess a valuable system. Every printer or other man in the offices is capable of managing a switchboard, besides attending to his routine duties. With the "interchangeable staff" everything works beautifully.

Press reports from California state that to aid him in his campaign for the position of postmaster, A. Bradford, a veteran of the Civil War, has forwarded to President McKinley an X-ray picture of his right leg, which was shattered by a cannon-ball at Fort Donelson. With the unique political picture the veteran sends his appeal and a numerously signed petition.

Owing to the recent sporadic appearance of smallpox in a Michigan town a few days ago the usual Sunday morning services of the churches were rendered by telephone. In the morning the local exchange made a circuit connecting as many of the subscribers who were church members as possible with their respective places of worship, and, at the appointed hour, singing, reading and 15-minute sermons were sent over the wires from the churches.

A coil of steel cable, long enough to reach from Bleecker street to South Ferry and back again, weighing more than 42 tons, was laboriously hauled from the foot of West Fourteenth street the other night to the Cable Building, at the corner of Broadway and Houston street, New York. The four miles of cable were wound on a steel spool weighing 7,300 pounds, mounted on a heavy truck whose wheels carried eight-inch tires. Thirty horses, driven by 15 shouting teamsters, were required to haul the load, which was so heavy that every manhole cover over which the wheels passed was broken. The cable is to be used on the "South Ferry section" of the road. Eighteen manhole covers were broken by the truck.

Chicago had a street fire recently that was unique in the records of the fire department. An electric car violently collided with a tank wagon which was carrying gasolene, 500 gallons of which were spilled into the street. In attempting to run the car on through the pool of gasolene the arcing between the rails and wheels set the inflammable liquid on fire and in an instant flames shot up 20 feet into the air, burning the car where it stood and severely scorching the buildings on either side of the street. The fire engines were called out but their streams had no visible effect on the blazing mass, which continued to burn for half an hour.

Considerable excitement and not a little amusement were occasioned recently in a New Jersey village by a lineman employed by the local street railway company. The company, it seems, had laid a certain line of track and the borough council sent a force of workmen to tear up the rails. Then the lineman got in his fine work. Climbing a trolley pole with a coil of copper wire on his arm, the man completed a circuit between the feeder and the rails. This resulted in a shock to all of the laborers, four of whom are said to have been "hurled several feet." Constables soon arrested the mischievous lineman, who was compelled to disconnect the wires, but it was some time before the workmen could be persuaded again to tackle the rails.

A farmer in Ohio has been made by his neighbors to pay a fine of $25 for eavesdropping over the telephone. Some time ago the farmers of Dresden organized a telephone company and installed their instruments on the party principle, by which arrangement all the bells on the circuit ring when a call is made. After awhile the subscribers became aware that some one listened to their telephonic conversations and they determined to find out who the eavesdropper was. It was, however, entirely by accident that the culprit was discovered. One afternoon a week or two ago two of the farmers were talking over the line when the unmistakable sound of a transmitter being removed from its hook reached them. Instantly they ceased their conversation and in the momentary silence that followed both distinctly heard the sharp, clear chime of a clock striking the hour. The clock in question had a chime whose peculiar tone when struck was familiar to both men, who at once knew who the listener was.

During the recent trials of the Marconi system at Oahu, Hawaiian Islands, one of the experts was flying a kite from a wagon in which was a set of wireless telegraph instruments, the kite being provided with a wire point. The expert, a Mr. Gray, was attempting to communicate with Kaimuka, which was but a short distance away, when the instrument began to tick, and the written characters of the Morse code appeared on the tape in the following sentence: "I have received your last six messages." In a few minutes he perceived that he had not received a message from his assistant at Kaimuka, but that it had come 40 miles across the channel from Molokai. Mr. Gray then attempted to attract the attention of the Molokai operator, and received as a reply a message which came along rapidly without stoppage of any kind. When six feet of the tape had been reeled off, and the period was printed, instead of the usual message of congratulations, the translation read: "To Mrs. Cross. Kindly kill Ah Sam for me because he did not pack up that small box nor the tin opener. My congratulations on your getting the first Molokai-Kaimuka wireless message. T. E. Hobbs." The message referred to Mrs. Cross's Chinese cook, whom Mr. Hobbs had secured.

The Magnetic Survey of the United States.

On July 1, 1899, a special division of the Coast and Geodetic Survey Office was created by the superintendent to take charge of the magnetic survey of the United States and the countries under its jurisdiction, which up to that time had been conducted under the supervision of the Computing Division of the Coast and Geodetic Survey, says *Science*. Since that date magnetic observations, namely, declination, dip and intensity of magnetic force, have been made up to December 31, 1900, at about 500 stations distributed over the United States, Alaska and the Hawaiian Islands. At most of the stations permanent marks have been established for the use of the surveyor. Special consideration has also been given to the needs of the mariner, especially in Alaskan waters, where occur places of pronounced local attraction, affecting the compasses on board ship all the way from one-fourth of a point to four points.

Special stations known as "repeat," or "secular variation" stations, have also been established in different parts of the country. At these observations will be repeated at stated intervals in order to determine the amount of secular change in the magnetic elements. It is the endeavor whenever possible to establish such stations in the vicinities of colleges and universities, as experience has shown that on college grounds we may hope for a permanency of station for a fairly long interval.

Of special state surveys mention may be made first of the completion of the magnetic survey of Maryland, which was undertaken primarily by the Maryland Geological Survey, with assistance rendered by this bureau; second, the completion of the magnetic survey of North Carolina, conducted under the joint auspices of this bureau and the North Carolina Geological Survey; third, the completion of the magnetic survey of West Virginia, and fourth, the completion of the magnetic survey of Iowa.

Fair progress has also been made in the establishment of the magnetic base stations, where the countless variations of the earth's magnetism will be recorded photographically. Thus a temporary magnetic observatory has been in operation at Baldwin, Kas., since July 1, 1900, and the buildings for the primary, or principal magnetic base station, located at Cheltenham, Md., 16 miles southeast of Washington, have been completed and the installation of the instruments is now taking place. Special declination readings from seven A. M. to four P. M. have been made at Gaithersburg, Md., since March 22, 1900, and at Sitka, Alaska, since October 1, 1900. The sites for the magnetic base stations at Sitka, Alaska, and near Honolulu, Hawaiian Islands, have been determined and preparations made for the erection of the buildings. It is intended to have these magnetic observatories completed in time for cooperation with the proposed Antarctic expeditions.

Special simultaneous observations have also been made on special days at various times, the purpose of these special observations being to determine over how large an area the variations as recorded at the base stations may be regarded as applying.

Various special investigations, both of an experimental and of a theoretical character, have been undertaken, and considerable attention paid to the thorough training of observers and to the proper correlation of the various magnetic instruments. During the Fall of 1899 a set of coast survey magnetic instruments was compared with the standard instruments at the following foreign observatories: Kew, England; Potsdam, Germany; Pavlovsk, Russia, and Parc St. Maur, France.

The following publications have been issued: Appendix No. 9, giving a general report of the magnetic survey of North Carolina, and Appendix No. 10 on the magnetic work of the United States Coast and Geodetic Survey; both appendices appearing in the "Report of the Survey for 1898-99." Good progress has also been made with the new addition of the Coast and Geodetic Survey magnetic declination tables and Isogonic charts for the United States and Alaska for 1900, designed especially for the use of surveyors and mariners. There has also been issued recently Bulletin No. 41, giving a general summary of magnetic declinations and of secular variation tables in North Carolina.

A Monument to James Bowman Lindsay.

It is proposed in Dundee to erect a granite monument over the grave of James Bowman Lindsay, in the Western Cemetery of the city, says *Nature*. Lindsay was a very remarkable man, whose memory should not be permitted to fade. He was born in 1799, and taught electricity, magnetism and other subjects in Dundee for many years, dying there about 40 years ago. In 1834 he foresaw that "houses and towns will in a short time be lighted by electricity instead of gas, and machinery will be worked by it instead of steam." This prediction was the result of his own observations of effects produced by the electric current, and not merely imaginative suggestions. In 1854 Lindsay transmitted telegraphic signals through water electrically, and when the British Association visited Aberdeen in 1859, he demonstrated the success of his method by transmitting signals across the harbor. He also read a paper upon it, entitled "Telegraphing without Wires." Sir John Leng has set on foot the scheme to commemorate the genius of Lindsay by a suitable memorial, and there should be no difficulty in raising the modest amount required for that purpose.

An Interview with Signor Marconi.

As announced in the ELECTRICAL REVIEW last week Signor Guglielmo Marconi, the wireless telegraphy expert and inventor, arrived in New York city on March 13. In answer to inquiries from a representative of the ELECTRICAL REVIEW, Signor Marconi said:

"I am visiting New York on business connected with the establishment of wireless telegraph stations to be used in connection with the steamships of several transatlantic lines which are now already equipped with my apparatus. These land stations will be similar to those on the other side, and the sighting and departure of ships will be accomplished by means of wireless telegraphy. I shall be here about two or three weeks and will then return to London, where I shall read a paper before the Society of Arts in April. I shall be back here again in June and will probably read a paper before your American Institute of Electrical Engineers.

"The latest improvements in my apparatus enable me to send 2, 10, 20 or 50 messages on the same instrument at the same time with no interference whatever. These messages are also received simultaneously by means of my apparatus with no interference. This is the latest development in my system of wireless telegraphy, although numerous mechanical improvements and specifications have been made in the last year or so."

In answer to a question, Signor Marconi said that the future of wireless telegraphy would depend largely upon developments which could not now be foretold. At present its most valuable use was in ship signaling, both between ships and between ships and the shore. Referring to long-distance service, Signor Marconi confirmed the reports of his recent success in transmitting messages distinctly over a distance of 200 miles in England. Signor Marconi also expressed pleasure at the kind treatment he had received from the American public and the American technical press.

Electric Railways

Mr. Thomas L. Johnson is said to be in London seeking parliamentary sanction for an electric railroad from the metropolis to Brighton.

Fire recently destroyed the car sheds of the Union Railroad Company, at Elmwood, R. I. Thirty trolley cars were in the buildings destroyed and the total loss reaches $162,000.

The usual quarterly dividend of one and three-quarter per cent will be paid on Twin City Rapid Transit preferred stock April 1. Books close on March 26 and open again on April 2.

The Richmond Beach, Staten Island, Railroad Company will run an electric or steam line from Arbutus Lake to the tracks of the Staten Island Rapid Transit Company near Anadale Station.

The recently incorporated Blue Grass Rapid Transit Company, of Kentucky, will connect the towns of Nicholasville, Versailles, Paris, Richmond, Midway, Georgetown and Winchester with the city of Lexington by an electric trolley system.

The Lancaster County, N. J., Railway and Lake Company, whose incorporation is noted in another column, has been organized to construct an electric light, power and gas plant and to operate and construct electric railways outside the city of New Jersey.

The wharves of the Halifax, Nova Scotia, Tramway Company will be replaced in the near future by a pier 210 feet wide by 180 feet in length, which will be finished by May 1. A 5,000-ton coal pocket, with automatic tramway to the power-house, will also be built.

The St. Louis & Belleville Traction Company will soon be reorganized, and the Suburban, Day and local lines will be incorporated in the near future under the name of the St. Louis & Belleville Traction Company with a capital of $2,000,000. These lines have changed hands recently and are now in the hands of Clark Brothers, of Philadelphia.

Confirmation of the recent report that Charles T. Yerkes had sold his street railway interests in Chicago, Ill., to Thomas F. Ryan has been obtained. The purchasing syndicate is backed by Mr. Ryan, Blair & Company, also of New York, and the Illinois Trust and Savings Bank, of Chicago. The purchase price was $5,000,000, or a little over the current market value of the securities sold.

Messrs. J. P. Morgan & Company, in the prospectus of the British Electric Traction Company, which has been recently organized with a capital stock of £2,000,000, guarantees the underwriting of £350,000 preference shares, and is said to have secured an option on taking £800,000 of the company's capital, with which it seeks to combine newly constructed and proposed electric railways in 40 English towns and cities.

The application recently made to the railroad commissioners of Massachusetts by the Worcester Consolidated Street Railway Company for permission to purchase and consolidate the Leaminster & Clinton, Worcester & Marlborough and Worcester & Suburban street railway companies has been granted, and the merging will be effected on a share for share basis. The issuance of $1,429,400 additional stock has also been granted for the purpose of exchanging shares.

For two years past the citizens and Summer residents of the aristocratic resort, Lenox, Mass., have fought the entrance of the trolley to their town with unabated vigor, but, at last, finding that it must come sooner or later, they accepted the situation as gracefully as possible. The line will be built within the year by the Berkshire Street Railway Company, which has agreed, in return for its franchise, not to use the public highway through the town.

Reports from Fort Wayne, Ind., state that A. A. Purman, a railroad attorney and organizer, has succeeded in organizing a syndicate to consolidate several important street railway lines with Lafayette as a centre. The syndicate is said to be capitalized at $800,000 and is backed by H. A. Holmes, W. R. Brown and others, whose idea is to buy up and consolidate as many of the city and interurban lines in southern Michigan, northeastern Indiana and northwestern Ohio as they can obtain.

Immediately after the recent arrival of Mr. Charles T. Yerkes in Chicago a meeting was held by the Northwestern, the Union Loop and the Lake Street Elevated companies for the election of officers. Clarence Buckingham was made president of the Northwestern Elevated Railroad Company; Clarence Knight, of the Lake Street Elevated Railroad Company, and J. B. Dennis, of the Union Loop Railroad Company. Mr. Knight, who was recently placed at the head of the Lake Street Elevated Railroad Company, was made counsel for the three companies.

It is believed by the citizens of Columbus, Ohio, that the incorporation of the Columbus, Delaware & Northern Traction Company warrants the supposition that Cleveland and Cincinnati will soon be joined together by electric lines. The southern terminus of the proposed railroad will be in Columbus, while the northern end will be in either Mt. Vernon or Marion. There is already a trolley line between Cleveland and Akron, and it is believed that the plan is to construct a continuous route between Cleveland and Columbus. When the Columbus, London & Springfield line is completed, it will be possible to ride from Columbus to Cincinnati, and it is believed that the connection of the two largest cities in the state is practically assured.

An agreement has been signed for consolidating the Loraine, Ohio, & Cleveland, Sandusky Interurban and Sandusky, Norwalk & Southern lines, including both local Sandusky lines under the name of the Lake Shore Electric Railway Company with a capitalization of $4,000,000. The consolidation was brought about by E. W. Moore, of the Everett syndicate, and J. H. Harding, for C. D. Barney & Company, of Philadelphia. It is believed by this deal that a chain of electric railroads will extend from Buffalo to Detroit, paralleling with the steam lines of the Michigan and Lake Shore railroads. The entire line will be completed during the coming Summer and the equipment of the road will be of the highest standard, the cars being estimated to have a speed of 50 miles per hour over a 70-pound rail. It is stated that none of the stock will be put in the open market.

Bills were recently introduced in the state senate of Indiana affecting street railway companies. Two of them are understandable but the third is considered somewhat vague. As the third bill reads it is believed that it would permit the consolidation of any interurban line with a city street railroad company. The measure states in brief:

"That any street railway company . . . engaged in the business of operating a street railway system by electrical power, in any city or town in this state, and which has heretofore extended or may hereafter extend its line or lines of street railway along or upon any public highways, to connect with the line or lines of another street railway system being operated by electrical power in any other city or town in this state, may purchase or otherwise acquire, own and operate such other street railway system, with all the property and rights of whatsoever character appertaining thereto."

PERSONAL.

Captain William Crozier, of the Ordnance Department, has declined an appointment as professor of natural philosophy at the West Point Military Academy to fill the vacancy caused by the death of Colonel Peter S. Michie. Captain Crozier has written Secretary Root saying that he considers it his duty to remain in the Ordnance Department, as in so doing he can better serve the army.

Mr. W. C. Jessup, a graduate of the engineering department of Columbia College, has associated himself with the Morris Electric Company, of New York city, and will devote especial attention to the Keystone electrical instruments for which this company is the New York agent.

Professor William Van Bergen Van Dyck, instructor in physics and electricity at Rutgers College, New Brunswick, N. J., was married on March 13 to Miss Frances Reynolds Johnson. Professor Van Dyck is also connected with the Marcus Prism Company, of New York city.

Hon. Charles H. Duell, Commissioner of Patents, on March 15 formally tendered his resignation to the President. It is said that one of the leading patent lawyers of New York city will receive the appointment if he will accept the office.

Mr. J. W. Peterson, of Chicago, has accepted an appointment on the staff of the Northern Electrical Manufacturing Company and the Stanley Electric Manufacturing Company. Mr. Peterson will make his headquarters in Chicago.

Mr. William J. Latta, of Philadelphia, has resigned the presidency of the Telephone, Telegraph and Cable Company of America, of New York city. He is still a director and a member of the company's executive committee.

Mr. Calvert Townley, manager of the Boston office of the Westinghouse Electric and Manufacturing Company, has been appointed general agent of the company, with headquarters in New York city.

Mr. Chester P. Wilson, of Milwaukee, Wis., has been appointed general manager of the Camps Bay, Cape Town & Seapoint Tramway Company, of Cape Town, South Africa.

Mr. William J. Barrett, of Los Angeles, Cal., has been appointed to take charge of the business of the Westinghouse Electric and Manufacturing Company in Southern California.

Honorable Thomas Lowry, the street railway magnate of Minneapolis, Minn., was in New York city last week.

The First Run of the Automobile Club of America.

On Saturday, March 16, the Automobile Club of America held its first club run of the season from the club house, at Fifth avenue and Fifty-eighth street, Manhattan, to Borough Park, Brooklyn, 22 automobiles being in the run. The start was made at ten minutes past eleven in the morning, and the destination—Church lane and Thirty-seventh street—was reached at twenty-five minutes past twelve. Mr. Albert C. Bostwick, first vice-president of the club, led the way in an electromobile. At Borough Park the drivers and their guests were entertained at luncheon by Mr. C. J. Field, a member of the club. At three o'clock the return was made with Mr. Bostwick again leading the way. Of the automobiles in the run 13 were gasoline machines, four electromobiles, three locomobiles, while a gasoline tricycle and a gasoline quadricycle completed the list. The weather was favorable and there being no mishaps *en route,* the outing was a success. Other similar runs are under consideration by the runs and tours committee of the club.

Semi-Annual Report of the Detroit Public Lighting Commission.

The commissioners of public lighting of the city of Detroit, Mich., have issued their fifth annual report for the year ending December 31, 1900, the six months ending December 31, 1900, being the first half of the fiscal year to June 30, 1901. The statement shows a cash outlay of $22.55 per arc lamp, thus comparing favorably with the cost for the previous corresponding period when the difference in the cost of fuel and amount expended for maintenance is taken into consideration. In spite of this fact the service given was the best shown in any report of the commission, as the number of hours on lamps out were less than any corresponding previous period and only about one-half of the lamp-hours-out in 1899.

Twin City Rapid Transit Company Incorporated.

All differences of the Twin City Rapid Transit Company, of Minneapolis, Minn., with the state officers have been settled, and on March 15 the Secretary of State granted the company a charter with a capital of $4,000,000 with permission to increase it to $20,000,000. The incorporators are Thomas Lowry, of Minneapolis; George Bliss, of New York; J. Kennedy Todd, of New York; George S. Coe, of Englewood, N. J.; John Kean, Jr., of Union Township, N. J.; Charles Fairchild, of Boston, Mass., and Henry A. Cannon, of New York.

Wall Street and the Electrical Stock Market.

On the New York Stock Exchange, General Electric closed the week at 210 bid and 211 asked, showing a loss of 5 points. General Electric furnished the market with the sensation of Monday, breaking sharply at one time from 216½ to 211, and later rallying to 214. The decline was on the announcement that the directors of the company had declared only the regular quarterly dividend of two per cent. In the preceding quarter an extra dividend of one per cent had been declared, and it was expected that something extra would be given the stockholders this quarter. The rally was on the announcement that in the suit of the company against the Lorain Steel Company a favorable court decision had been handed down. Metropolitan Street Railway, of New York, closed at 167¼ bid and 167½ asked, indicating a gain of 2¼ points. Brooklyn Rapid Transit closed at 82¼ bid and 82⅜ asked, showing a gain of 3⅝ points for the week, or a gain of 8 points for the two weeks. Third Avenue Railroad closed at 121 bid and 122½ asked, showing a loss of ½ point. Manhattan Railway, of New York, closed at 125 bid and 125⅛ asked, indicating a gain of 5⅞ points for the week.

The Kings County Electric Light and Power Company, owning and operating the Edison Illuminating Company of Brooklyn, and other electric lighting companies of Kings County, has made notable advances in the value of its stock during the past few weeks. The last sale of a small lot was at 188, and it is predicted by insiders that the stock will reach 250 within 60 days. A union of the gas and electric interests of Brooklyn is expected.

On the Boston exchange, American Telephone and Telegraph closed the week at 159 bid and 160 asked, showing a loss of 1 point. Erie Telephone closed at 53 bid and 60½ asked, indicating a loss of 2½ points. New England Telephone was not quoted.

On the Philadelphia exchange, American Electric Storage Battery was not quoted. Electric Company of America closed the week at 8¼ bid and 8½ asked, indicating a loss of ½ point. Union Traction closed at 30⅜ bid and 31 asked, indicating a loss of 1⅛ points for the week.

On the curb, or outside market, in New York, Electric Vehicle closed the week at 14½ bid and 16 asked, showing a gain of ½ point. Electric Boat closed at 24 bid and 27 asked, indicating no change in the bid price for the week. Consolidated Equipment closed at 11¾ bid and 12⅛ asked, showing a gain of ½ point in the bid price for the week.

Wall street, March 16.

Telephone and Telegraph

The city council of Elwood, Ind., has been requested to grant a franchise to the Anderson Telephone Company for a system in that town.

The farmers of Henry County, Ind., have organized the Henry County Telephone Company, with a capital of $10,000 for local purposes.

The Hanover & Henrico Telephone and Telegraph Company, of Kentucky, has recently been chartered for $5,000 by M. D. Hart and E. S. Campbell.

The annual meeting of the stockholders of the American Telephone and Telegraph Company will be held at the office of the company, 15 Dey street, New York, on Tuesday, March 26, 1901, at 12 o'clock.

The Western Electric Company is said to be preparing a new schedule of prices for material it furnishes the Bell subsidiary companies, quoting a large reduction in prices. The discounts vary from 20 to 50 per cent.

The New York & New Jersey Telephone Company on March 15 filed with the Secretary of New York State a certificate of increase of its capital stock from $8,000,000 to $15,000,000. The company has a paid-in capital of $7,500,000 and debts and liabilities of $2,588,247.

The new telephone line which is being built between Farber and Hutchison, Mo., is expected to be in operation within a very short time. The line is 11 miles long. The officers of the company are R. E. Sisk, president; C. A. Davault, secretary, and William Lake, treasurer.

The Bell Telephone Company of Canada has increased its capital stock from $5,000,000 to $10,000,000. In addition to this a bond issue of $2,550,000 has been authorized. Nearly a controlling interest in this company is owned by the American Telephone and Telegraph Company.

The toll line of the Bell company in Wichita, Kas., has been finished so that long-distance connection can now be had to Kansas City and eastern points as well as points in Oklahoma and Texas. The business of the local exchange is said to have increased a hundred per cent in the last year.

An ordinance was recently recommended to the common council of Chicago, Ill., granting a franchise to the United Telegraph and Telephone Company, of Hyde Park, which will be under contract to furnish service at what is believed to be half the rates maintained at present.

The local authorities have recently signed an ordinance granting a franchise to the Kinloch Telephone Company to operate a system in the city of Alton, Ill., and it has been stated by a representative of that company that construction work will begin on the first day after the ordinance is put through.

A petition has recently been presented to the city authorities of Dublin, Ga., to establish and maintain a telephone exchange in that city. For some time past the company has operated a long-distance line between the two cities but has not heretofore attempted to compete with the Dublin system for local business.

A company which is soon to apply for a charter is the Southern, of Knoxville, Tenn., which will ask to be chartered at $25,000 for the purpose of furnishing poles and constructing exchanges for independent telephone companies. W. O. Rhode is president; W. S. Roberts, vice-president, and C. L. Myers, general manager.

Two applications were recently made for franchises by rival companies to the aldermen of Buffalo, N. Y., and both applications were sent to the committee on streets. The two companies which requested franchises were the Queen City Telephone Company, H. H. Littell, president, and the Buffalo Telephone Company.

The recently incorporated Union Telephone Company, of Pemberton, Pa., has been organized to serve the towns of Pemberton, Lewiston, New Egypt and other places in the vicinity. When the line is completed to New Egypt connections will be established there with the Burlington County Telephone Company's lines.

Connections with Victory and Tyus have just been completed by the Gainesboro Telephone Company, of Carrollton, Ga. The two first-named towns are said to be important country points, and the company which completed long-distance connections at Carrollton last Fall has begun to extend from Bremen to Waco, and intends soon to have connections with Tallapoosa.

The recently incorporated Wyandotte Valley, W. Va., Telephone Company, of Huntington, is engaged in the construction of telephone systems, and Mr. T. S. Scanlon is in charge of the work. The capital stock of the company is reported at $5,000, with the privilege of increasing to $25,000. The incorporators, besides Mr. Scanlon, are R. L. Archer, J. W. Hambrick, C. B. Campbell and George I. Neal.

By the consolidation of the local, the Cumberland, and the City Suburban Telegraph companies, the merchants of Cincinnati, Ohio, will be able to talk to their customers and representatives throughout the South. The consolidation and perfection of the connections will require the stringing of some 300 miles of telephone lines by the company, which already covers half a dozen counties in Kentucky.

It was recently reported that arrangements are soon to be made for entirely remodeling the Interstate Telephone Company's lines and that when the work is completed the company will give service which will be equal at least to that given by any other company in the state of New York. The Interstate company has connections in all villages to Poland and Canada Lake on the north, to Gloversville and Amsterdam on the east, and to Utica on the west.

Capitalists of Cleveland, Ohio, are interested in a new telephone system for the state of Michigan and expect to form a new company to control the independent telephone interests of that state with particular reference to the city of Detroit. Prominent among these gentlemen is Mr. Henry A. Everett, president of the Federal Telephone Company, of Cleveland. Mr. Everett recently stated that the company would soon be incorporated with a capital of $2,000,000.

The reorganization of the Mississippi Valley Telephone Company, of Minneapolis, Minn., will probably be accomplished before the month is over and the affairs of the concern placed on a working basis. The company recently went into the hands of a receiver, and as the time for filing claims against it has expired, that gentleman is now preparing his report for the court. This will soon be submitted and the capitalists, who are from Minneapolis and St. Paul, think that the proposition will be found acceptable by the court, and that affairs will be in good shape by April.

Reports of the Cooperative Telephone System at Grand Rapids, Wis., state that the city has enjoyed a service not only efficient, but remarkably cheap. The

company in question was organized in 1896, with a capital stock of $5,000, and any one could become a member of the company by subscribing for one or more shares and leasing one telephone for each share of stock he owned. By this means the company was controlled by the telephone renters for their sole benefit. It is stated that the company now rents 300

FIG. 1.—HAND TELEPHONE FOR HOTEL SERVICE.

instruments, and has increased its capital stock to $10,000.

William Gray, of Hartford, Ct., has invented a system of open-air telephones which are to be installed in that city within a few weeks. The little telephone stations have the same appearance as the police telephone boxes and will be placed on street corners. To open the machine a coin is dropped through a slot in the door and may be reclaimed as soon as the door opens. Inside the box is the regulation outfit worked on the slot system. The door of the box is said to be on hinges and shuts itself by gravity after the telephone has been used.

At the recent meeting of the Hudson River Telephone Company, besides increasing their stock by $1,000,000, the directors elected the following officers and submitted the report given below in brief: James H. Manning, president; Jeffries Wyman, vice-president; Walter B. Butler, secretary and auditor; James J. Fitzsimmons, treasurer; Henry E. Hawley, general manager. Directors: Joseph P. Davis, New York city; John E. Adriance, Poughkeepsie; C. Jay French, Boston, Mass.; John G. Myers, Albany; James H. Manning, Albany; D. Cady Herrick, Albany; George P. Ide, Troy; Walker C. Humstone, New York; Jeffries Wyman, Boston, Mass.

	1899.	1900.
Gross revenue.....	$427,461 57	$519,679 78
Gross expenses.....	282,889 80	351,880 05
Net revenue.....	$144,571 77	$167,799 73

Ericsson Hotel Telephones.

In the model hotel or apartment house of to-day, telephones are quite as necessary as elevators and mail chutes. After many unfavorable experiences, architects, engineers and contractors have gradually discarded cheap and inefficient telephone apparatus and are choosing more for quality and durability than price. For these reasons the New Hotel Essex, in New York city, is equipped with genuine Ericsson telephones and switchboard, which give quick communication from every suite and hall to the office, and place the management within easy reach of every patron. The room telephones are all of the hand microtelephone pattern, as shown in Fig. 1, and instead of being

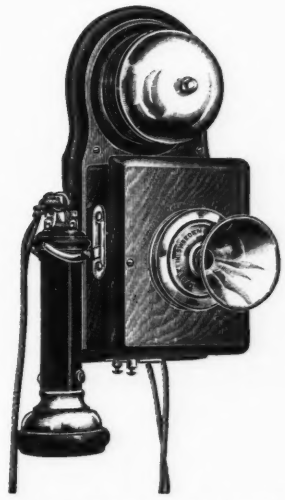


FIG. 2.—WALL TELEPHONE FOR HOTEL SERVICE.

a disfigurement to the wall they serve as an ornament to the finely finished suites. Each of these is fitted with a flexible cord of sufficient length to enable the patron to call the office, or to answer a call if desired, without rising from the couch or bed. When through using, the releasing of a lever in the handle makes and breaks all necessary connections and it is not necessary to replace on a hook, as in ordinary telephones. When first introduced, the hand microtelephone was considered a curiosity, but its utility and compactness has made it a great favorite, and it bids fair to soon take the place of the once popular nickel desk set, and in many cases replace the wall instrument as well. In operation, the office is called by simply pressing the contact in the handle of the hand microtelephone, which act throws the drop at the switchboard. The operator connects in the usual manner, answering the call, and if desired calls some other suite and enables the two to converse. The call to the suite is made by a small musical gong, placed near the ceiling, which, while loud enough to call a person, is not harsh enough to disturb one. As shown in Fig. 2, the wall telephone for use in the halls is neat, compact, and takes small space. It is fitted with the standard Ericsson receiver and transmitter, now so well known. In operation it is used in the usual way, the act of taking the receiver from the hook sending the call for the operator in the office.

With both instruments, when the line is released, the operator is at once notified and quickly disconnects. The switchboard is shown in Fig. 3. Besides being positive and rapid in operation, it is of the finest mechanical construction, is very durable, is handsomely finished, and while occupying very little space compared to its capacity, is of a peculiar design which distinguishes it from ordinary boards. The system is operated by centralized batteries and is so arranged that when desired a motor-generator can be thrown into circuit for calling. In addition to this system, the Ericsson

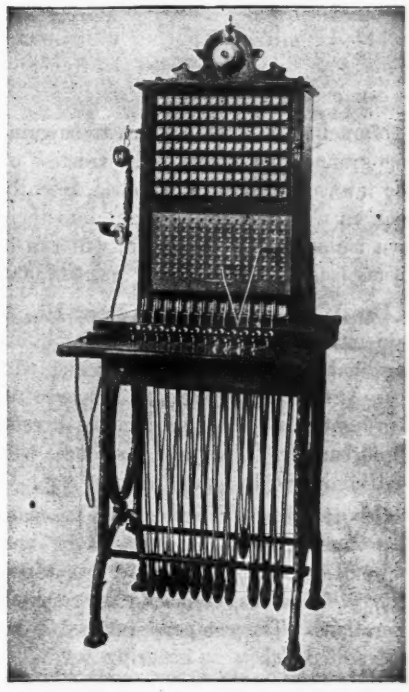


FIG. 3.—SWITCHBOARD FOR HOTEL TELEPHONE SERVICE.

Telephone Company, 296 Broadway, New York, makes a number of different systems and telephones of special design and finish for special uses, including intercommunicating patterns and for exchange service.

A telephone exchange will soon be installed in New Carlisle, Del.

Electric Lighting

The citizens of Midway, Ky., are said to be considering an electric light plant for that town.

Hagerstown, Md., will soon begin the construction of a municipal electric light plant which will be installed at a cost of about $14,000.

The proposed light plant at Brocton, N. Y., will soon be put in at a cost of about $8,000 by an electric construction company of Indiana.

The electric lighting plant at San Saba, Tex., is rapidly nearing completion, and is expected to be in commission before the end of the month.

The Norwich, Ct., electric light plant has recently been sold to the Norwich Gas and Electric Light Company, which purposes to put the plant in first-class condition at the earliest possible moment.

A recent incorporation is that of the Bucyrus, Ohio, Gas and Electric Company, which will supply gas and electric light. It will also put in a hot-water heating apparatus, provided the franchise is granted by local authorities.

Municipal ownership seems to be gaining ground in Canada. The trustees of the town of Woodstock, Ontario, recently took an electric lighting plant into their own hands and in the future will run it themselves. The price paid was $14,000.

Dr. J. A. Hale, of Alto Pass, Ill., is said to be making preparations for lighting that town with electricity and will soon install a dynamo of proper size. Arc lights are to be placed in the streets, while business houses and residences will be illuminated by incandescents.

Reports from Rochester, N. Y., state that the Citizens' Electric Light and Power Company, whose plant was wiped out by fire last December, has resumed operations. The company suffered from unexpected delays in securing its lighting and power machinery. Everything is now installed and business has been resumed.

A proposition is on foot to illuminate the Yosemite Falls by means of 20 arc lights which will provide color effects. The falls are 2,200 feet in height and will present a wonderful spectacle when illuminated. The effect will be greatly enhanced by the colors. It is also stated that some of the roads in the vicinity of the falls are to be lighted by electricity.

A recent increase in the capital stock of the Canton, Ohio, Light, Heat and Power Company is understood to have been made with a view to inaugurating extensive improvements in order to increase its capacity and efficiency. The demands made upon it at the present time are so great that the company is unable to take care of all the business offered to it.

Mr. Charles A. Lux, of Clyde, N. Y., who represents the Electric Light Syndicate, is building a lighting plant in Clyde for that company and is said to have announced as the intention of the syndicate the securing of controlling interests in electric light plants along the line of the central Hudson, and where it can not secure control of these plants, to start opposition plants and also to install new ones in villages which at the present time have no electric lighting systems.

A bill was recently introduced into the legislature at Albany, N. Y., to place the state board of railway commissioners in control of all gas, electric light, heat and power corporations so as to confer upon the commissioners additional powers relative to the issuance of certificates of public necessity. The amendment to the bill authorizes not only the additional powers mentioned, but permits the commissioners to allow the extension in whole or in part of pipes, wires, etc., in all the cities and villages of the state.

The lighting situation in Richmond, Ind., has been complicated by the suit brought by several of the taxpayers on the ground that the contract let by the city council for the illumination was too expensive. An Indianapolis company obtained the business for $144,000 and the citizens entered suit. Then the common council of Richmond demurred to it and at the trial Mr. Justice Fox handed down a ruling sustaining the demurrer. The work is proceeding with all possible speed.

A large power plant is to be built at Egg Harbor City, N. J., to furnish power for lighting towns in the vicinity and also to transmit motive power for railroad systems and lighting plants in Vineland, Pleasantville and Atlantic City. Terminal facilities are said to have been secured for a trolley system by the capitalists, who have incorporated the proposed line. They also have given their attention to a road which will connect Port Republic, Mays Landing and other villages along the shore with Egg Harbor.

The promptness of the fire department of Philadelphia, Pa., was all that saved the plant of the Edison Electric Light Company in the Quaker City from destruction by fire a few days ago. By the time the firemen arrived on the scene of conflagration the flames were pouring from the windows of the third story. Without a moment's hesitation the firemen rushed into the building and in a few moments the fire was extinguished. The men were greatly hindered by the network of wires throughout the building, and it was considered remarkable that no one was injured. Still more remarkable was it that not a light on any of the circuits which received their power from the Edison company's station went out.

A change which cost $450,000 has been made in the Allegheny Lighting Company's plant for the supply of electrical illumination to the residents of the fashionable East End district of Pittsburgh, Pa. The improvements consist of the abandonment of the company's old Broad street station and the installation of a large power plant in Glenwood. The current is sent from this plant a distance of over six miles and is used in East Liberty and the East End in Pittsburgh. The amount of energy transmitted from the Glenwood power-house is 2,400 horsepower, which is said to be the largest amount of power ever sent over the wires in the state of Pennsylvania. An important feature in the plant is the saving of expense for coal haulage, inasmuch as barges can come up the river and unload directly into the power-house bunkers, instead of having the coal hauled in trucks as was necessary before.

No Light Consolidation in Boston.

Press reports received on Tuesday from Boston, Mass., state that an officer of the Boston Electric Light Company said on Monday: "The bill which the gas commissioners will present to the legislature this afternoon relative to a consolidation of Boston electric light companies does not imply that such a consolidation will take place. As I understand it the bill is for the purpose of preventing a consolidation of the companies by any outside parties such as was recently proposed by the Morgan syndicate. There is no electric light consolidation under consideration."

Death of Hon. H. R. Barker.

Hon. Henry R. Barker, of Providence, R. I., died suddenly at his home on Sunday, March 17. The cause of his death was heart disease.

A Simple Form of Boiler Tube Cleaner.

The cleaner represented in the accompanying illustrations is adapted for cleaning either the outside or inside of boiler tubes, its method of operation being claimed by the maker, the Power Specialty Company, of Buffalo, to be

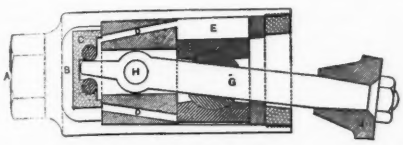


FIG. 1.—A SIMPLE FORM OF BOILER TUBE CLEANER.

different from that of other such appliances. In the sectional view steam is admitted by means of a flexible hose through the coupling, A, to the chamber, B. In this chamber is a valve, C, regulating the admission of steam alternately to the ports, DD, through which it flows to the cylinder, E, operating the steel piston, F. The movement of this piston causes the arm, G, to vibrate; this arm is pivoted at H. The rearward extension of this arm operates the valve, C, by striking the steel shoulders, II. On the end of the arm, G, is a hammer, J, held in place by the nut.

It is claimed that this apparatus is highly efficient in operation and that its singular hammering and blowing action accomplishes very desirable results.

Telephone, Telegraph and Cable Company of America.

A circular has been issued to the stockholders of the Telephone, Telegraph and Cable Company of America calling a special meeting to be held in Jersey City, N. J., on March 26, at which it is proposed to terminate the assessable feature of the stock by reducing its par value to $15, the amount that has been called on the present par value of $50 per share. As there are 600,000 shares this will make the paid-up capitalization $9,000,000. There are said to be many delinquent stockholders and they are asked to pay their assessments in arrears on or before April 2.

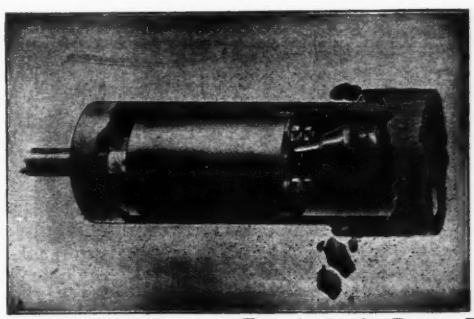
New York Electrical Society.

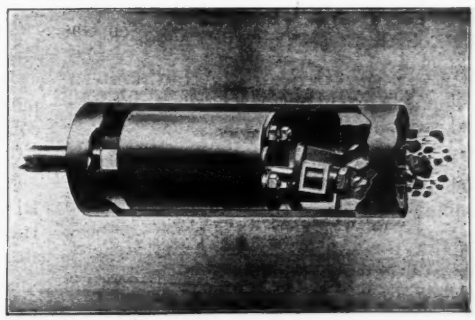
The 213th regular meeting of the New York Electrical Society will be held at the new station of the New York Electric Vehicle Transportation Company, Eighth avenue and Forty-ninth street, New York, at eight o'clock, on Wednesday evening, March 27.

LATE NEWS.

The cables for the new East River Bridge arrived in New York on March 18, and have been placed in position ready to be carried across the river, the spools being loaded on floats. It has not been decided when the first cable will be swung into place, but one end of it has already been carried over the Manhattan tower of the bridge, and is in readiness to be hauled taut.

Fire crippled the plant of the National Carbon Company at West Madison and Highland avenues, Cleveland, Ohio, early in the morning of March 18. Shortly after the fire was discovered there was a terrific explosion of chemicals, which wrecked part of the building. Two men were imprisoned within the burning structure, but were dug out by their comrades, receiving only slight injuries. The loss approximates $100,000.





FIGS. 2 AND 3.—BOILER TUBE CLEANER IN OPERATION.

Consular reports from Bergen, Sweden, tell of a successful production of steel by electricity. The experiments were carried on in the Gysinge factory, where about 25,000 pounds of steel are produced in six drafts daily. The steel is said to be of excellent quality, and sells at high prices. On account of its relatively cheap production the profits are large, but the output insignificant as the power is very limited. Plans have been formed for the erection of another similar plant on the banks of the Dalalfuen River, the power of which will be utilized, thus enabling the company to carry on the manufacture of steel on a large scale.

The large dam of the People's Tramway Company, situated two miles south of Danielson, Ct., gave way on March 18, letting loose a body of water two and one-half miles long, and rendering useless the works of the company, which had that same day been placed in operation for running the street railroads from Danielson to Worcester. The sluice gates of the dam were carried away first, and after them went the supporting posts, the resulting gap widening with every hour. It is believed that a quicksand underground was the cause of the accident. The plant was one of the largest of its kind in the country, and was put in operation at ten o'clock in the morning, the dam bursting at four in the afternoon. The loss to the company will reach about $30,000.

The Phonograph in a New Rôle.

James Demosthenes, of Ansonia, Ct., left his parents in Mitylene, on the coast of Turkey, some years ago, and decided to carve out his fortune in this country. Occasional letters to the old folk told how he was getting along, but as his parents could not read or write, this means of communication failed to give that exchange of individuality which is the real charm of affection or friendship. So Mr. Demosthenes bethought him of the phonograph, and his partner, also a native of Mitylene, is carrying one of these "talking machines" and two records as a present to the aged father and mother. On one of these records Mr. Demosthenes has had a chat with his father and on the other he has inscribed a message for his mother's ear and heart, says the New York *Times*. And after the man who is carrying the novel gift has traveled some six thousand miles he will set the machine in order and these old folk will listen to the voice of their son in far-off America and they will forget time and space while the well-loved tones call up those memories most dear to a parent's heart.

Then the machine will be set again and the parents will speak to their son. How surprise and tenderness will blend in their tones at the unusual manner of communication and the fancy that in some mysterious manner the personality of their correspondent is hidden in the wheels and cylinder of the machine! Then in a little while the son will hear the voices of his father and mother and the unique cycle of thought interchange will be complete.

This is a new field for the phonograph, and its possibilities are without limit. When this machine is safely installed in the home of those Turkish parents the son may send his letters in the shape of cylinders and the old folk may answer in the same manner. And whenever the son grows homesick, or the parents feel lonely with longing, they only have to turn to the phonograph and let it speak to them one of the letters—old as to wording, but ever new in the loved accents so well remembered.

Corporation News

BALTIMORE, MD. — Acme Fuse Company. $100,000.

LEHIGHTON, PA.—Overland Telephone Company. $15,000.

INDIANAPOLIS, IND.—Commercial Electric Company. $23,700.

CHICAGO, ILL.—Independent Telephone Company. $3,000. Incorporators: J. J. Comer and others.

PITTSBORO, IND.—Pittsboro Telephone Company. $3,000. Incorporators: C. Lander, D. W. Lewis, S. James.

COEYMANS, N. Y.—Ravenna Electric Company. $10,000. Directors: A. Nodine, S. W. Mosher and N. Niles.

ROCHELLE, ILL. — The Ogle County Telephone Company has increased its capital stock from $10,000 to $50,000.

COLUMBUS, OHIO—The Northwestern Telephone Company has increased its capital stock from $20,000 to $40,000.

PORT JERVIS, N. Y.—The Port Jervis Telephone Company will soon increase its capital stock from $9,000 to $15,000.

NEW BERLIN, N. Y.—New Berlin Telephone Company. $3,000. Directors: I. L. Richer, E. G. White and A. H. Phelps.

LYONS, N. Y.—Lyons Electric Railway Company. $45,000. Directors: C. A. Lux, D. E. Lux and C. F. Lux, Clyde.

TRENTON, N. J.—Indian Rift Power Company. $2,000. Incorporators: L. I. Fletcher, C. E. Griffiths, J. S. Stewart.

GREENVILLE, ME. — Moosehead Telephone Company. $10,000. Incorporators: C. D. Snow and Charles A. Judkins.

GUTHRIE, O. T. — Osage Telephone Company. $10,000. Incorporators: E. N. Yates, W. Brideville and E. B. Graves.

CUBA, N. Y.—Cuba Telephone Company. $12,000. Directors: Charles and Clarence Richter, G. H. Swift and others.

TRENTON, N. J.—Metallic Duct Company. $100,000. Incorporators: K. K. MacLaren, J. I. Billings and H. S. Gould.

DANVILLE, VA. — Standard Electric Company. $5,000. J. G. Penn, president; J. M. Williams, secretary and treasurer.

FORREST CITY, ARK.—Forrest City Ice and Power Company. $40,000. James Fussell, president; F. M. Polhamius, secretary.

RICHMOND, VA.—Hollins Internal Improvement Company. $25,000. Incorporators: A. L. Smith, T. L. Martin and others.

NEW YORK, N. Y.—Clark Economic Power Company. $10,500. Directors: W. D. Mann, L. M. Hartog and J. A. Patten.

ROCHESTER, N. Y.—Genessee Valley Telephone Company. $100,000. Directors: J. F. Warner, G. R. Fuller and E. M. Higgins.

LAFAYETTE, MACON COUNTY, TENN.—Union Telephone Company. $5,000. Incorporators: H. C. Smith, W. H. Carter and others.

OSAGE, IOWA—Mitchell County Telephone System. $15,000. Incorporators: G. E. Marsh, C. F. Bennett, J. W. Barrett and others.

LANSING, MICH.—Caro & Lake Huron Electric Railroad Company; $200,000. Detroit & Chicago Railway Company; $4,000,000.

TRENTON, N. Y. — Safford Electric Manufacturing Company. $250,000. Incorporators: L. E. Safford, J. G. Quinn, Eugene Berry.

RAVENNA, OHIO—The Ravenna Home Telephone Company has increased its stock from $10,000 to $20,000 to provide for extensions in its service.

DOVER, DEL.—Magneto Electric Company, of New York city. $1,000,000. Incorporators: L. E. Miles, W. S. Van Prockin, W. H. Rowen.

MILWAUKEE, WIS.—Badger State Long-Distance Telephone Company. $100,000. Incorporators: W. H. Hatch, F. T. Brewster and F. A. Philbrick.

JANESVILLE, WIS. — Beloit, Delevan Lake & Janesville Railway Company. $10,000. Incorporators: T. A. Nolan, J. Earle and E. H. Peterson.

JERSEY CITY, N. J.—Thos. Hoey Supply and Manufacturing Company. $200,000. Incorporators: P. J. Kennedy, J. J. Quigley, K. K. McLaren.

ALBANY, N. Y.—Subscribers' Telegraph and Telephone Company. $15,000. Directors: D. S. Johnston, William R. Condon, C. F. Rogers and others.

STEUBENVILLE, OHIO—Steubenville & Pleasant Heights Traction Company. $150,000. Incorporators: G. A. Maxwell, G. K. Canfield and others.

LANCASTER, PA. — Lancaster County Railway and Light Company. $2,000,000. Incorporators: P. B. Shaw, S. R. Shipley, W. B. Given and others.

ALLENTOWN, PA.—Philadelphia, Trenton & Lehigh Valley Railroad Company. $700,000. Directors: A. L. Johnson, J. E. Kenney, C. M. Bates and others.

NASHVILLE, TENN. — Tennessee & Northwestern Railway Company, of Hamilton County, $50,000. Incorporators: J. L. Bell, F. M. Thompson and others.

ST. PETERSBURG, FLA.—Florida Sub-Peninsula Transportation Company. $1,000,000. John P. Martin, president; Charles Orr, vice-president; J. P. Martin, Jr., secretary.

WARSAW, OHIO—The Farmers and Merchants' Telephone Company has increased its capital stock from $5,000 to $15,000. J. P. Darling, president; S. C. Kirsner, secretary.

TRENTON, N. J.—The Union Traction Company, recently incorporated for $1,000,000, has increased its capital to $15,000,000, one-half being preferred stock with a five per cent cumulative dividend.

CINCINNATI, OHIO — People's Water and Electric Light Company. $20,000. Paid-up capital, $12,000. Directors: W. H. Bond, L. J. Crawford and others. The company's indebtedness is limited to $10,000.

BUFFALO, N. Y.—West Side Wagonette Company. To operate vehicles to and from the Pan-American Exposition grounds. $50,000. Directors: C. P. Dunbar, H. J. Koch, R. L. Cox and J. F. Dunn, Buffalo.

TORONTO, CANADA—The Electric Cab Company has increased its capital stock from $15,000 to $100,000, to extend its operations to other Canadian cities. C. A. Ward, president; A. M. Thomson, vice-president; W. S. Jackson, secretary-treasurer.

CINCINNATI, OHIO — Cincinnati, Milford & Hillsboro Railway Company; $10,000; incorporators: E. L. Warson, J. B. Higgins and others. Cincinnati & Lebanon Railroad Company; $10,000; incorporators: J. I. Stephenson, Frank Gahr and others.

LYONS, N. Y.—Lyons & Sodus Bay Railway Company. $400,000. Directors: J. D. Bashford, C. Hotchkiss, C. P. Williams and Daniel Barton, of Lyons; S. W. Case, of Sodus; D. B. Platt, C. Van Voorhis, I. H. Ludington and S. G. Hollister, of Rochester.

Seattle Electric Company.

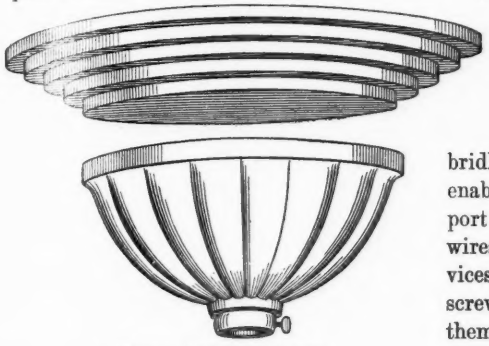
At a meeting of the directors of the Seattle, Wash., Electric Company, held March 13, the first regular quarterly dividend of one and one-half per cent on the preferred stock was declared payable April 1 to stockholders of record March 15. The Seattle Electric Company was organized in January, 1900, to take over and operate the properties of nine railroads and three light companies in the city of Seattle. Its capital stock consists of $5,000,000 of common stock, $1,250,000 of preferred—all of which will be issued.

American Electrical Apparatus Wanted in Australia.

The ELECTRICAL REVIEW is informed that Mr. C. E. Wearne, an electrical contractor in Perth, western Australia, desires to secure several agencies for American electrical supplies and apparatus used in mining work. He desires that American electrical manufacturers will correspond with him.

A Novel Fixture Block.

An interesting electrical specialty is the fixture block herewith illustrated, which is so arranged that the various steps on it fit several standard sizes of canopies. It is made for four sizes—three, three and one-half, four and four and one-half inches in diameter. When a canopy is placed on the block it can not slip to one side and is firmly fixed in a central position about the stem of the fixture. It is plain that the block has other obvious advantages which will be recognized by those using such goods. It is manufactured by the H. C. Roberts Electric Supply Company, of Philadelphia, Pa.



A Novel Fixture Block.

Bell Telephone Estimates.

It is estimated that from $10,000,000 to $20,000,000 will be required during the ensuing 12 months by the American Telephone and Telegraph Company to provide for its proportion of the increase on the part of its licensed companies to provide for extensions and improvements. The majority of the stock in these companies is owned, in nearly every instance, by the American Telephone and Telegraph Company and therefore the bulk of the money will have to be provided by it, probably through the sale of stock. As the market price of A. T. & T. stock is around 160 and the stock will presumably be issued at par to stockholders, "rights" will be of considerable value to the present stockholders. It is evident that a great deal of additional money will be needed to provide necessary funds to pay the cost of connecting in new subscribers and building the necessary toll lines and expanding the business as demands require. If this new money is not continually furnished the subsidiary companies for these extensions, the money heretofore paid in dividends will be required for operating and construction expenses, and this would prevent the payment of dividends as in the past and which amounted to nearly $4,000,000 paid to the American Bell company during 1899.

Improved Telephone Construction Accessories.

One of the recent improvements in accessories for telephone line construction, and which should be of importance to telephone managers who are solicitous of having their plants up to date, is here shown in the shape of an insulated bridle ring for distributing telephone wires. These bridle rings are valuable in the way of enabling the wiremen to get good support and insulation for their telephone wires, as well as being labor-saving devices. They are provided with a wood screw shank, which enables one to place them in the most difficult and out-of-the-way places; in fact, a man can put one in position without any other tool than his hand, as far as he can reach. They are also readily taken down and removed from place to place as may be desired; and, besides, wires are easily inserted and removed therefrom at any time and without damaging either the wires or the insulators.

Expanding Sleeve.

Insulated Bridle Ring.

Messrs. James S. Barron & Company, of New York city, who are the sole manufacturers, will be pleased to furnish samples to those who are not already familiar with these popular insulators. The rings are made in several sizes; the opening on the side is one-quarter inch in the larger sizes, and three-sixteenths inch in the smaller size. The small size has an inside diameter of five-eighths inch. The illustration here shown is approximately full size of style "A" bridle ring, which is one and five eighths inches inside diameter; the shank is one and one-quarter inches long. An illustration is also shown of an improved expanding sleeve which is used with the H-P insulated bridle rings in brick, stone or iron work. These sleeves work on the same principle as the regular expansion bolt, the wood screw of the bridle ring taking the place of the bolt.

Westinghouse Dividend.

The directors of the Westinghouse Electric and Manufacturing Company have declared the regular quarterly dividend of one and three-quarters per cent on the preferred stock to stockholders of record April 1. Books close March 23, reopen April 2. The directors have also voted to issue $3,000,000 par value of the recently authorized increase in capital stock; price, terms and conditions of issue to be determined upon the recommendation of a special committee at the regular board meeting to be held March 27.

Antiseptic Mouthpiece for Telephones.

The accompanying cut shows a new antiseptic mouthpiece for telephones and speaking tubes which has been on the market a short time and has met with considerable favor. Much has been said within the last few years regarding the fact that germs of disease congregate within the transmitter of a telephone, and dangerous consequences are the result. This mouthpiece is filled and refilled with an antiseptic solution which disinfects the mouthpiece and prevents the accumulation of bacilli. The boards of health in various cities take every precaution to guard against contagion of every description and this appliance has received the endorsement of several physicians. It is manufactured and sold by the National Electric Appliance Company, of Philadelphia, Pa.

Antiseptic Mouthpiece for Telephones.

A new telephone line will be erected between Fort Dodge and Waterloo in order that the citizens of those two towns may have better facilities for the pointing out of each other's shortcomings.—*Des Moines* (Iowa) *Capital.*

Industrial Notes

THE McROY CLAY WORKS, Brazil, Ind., and New York, is mailing its monthly blotter-calendar for March. On the face of the card is a verse, "Grip," quoted from the Baltimore *American*. The blotter will be sent post paid upon application.

LAUFKETTER & BENDIT, 808 Olive street, St. Louis, Mo., are mailing their calendar for 1901. This firm does engineering and contracting work, and will mail catalogues of steam, electric and hydraulic apparatus upon application.

THE HARDY LAMP COMPANY, Pittsfield, Mass., has recently shipped large quantities of its well-known lamps. The company claims these lamps to be of very high efficiency and states that each and every lamp is put through a severe practical test before it is finished and sent out from the factory.

BLUE ISLAND, ILL., has recently installed a 2,500-light Warren inductor alternating plant, the series enclosed alternating arc lamp being furnished by the Manhattan General Construction Company, of Newark, N. J. A large number of 50-candle-power incandescents are run in series with the arc lamps.

THE *NORTH AMERICAN REVIEW* for March contains a number of unusually interesting articles, among which are included the "King of England," by Sir Charles W. Dilke, Bart.; "Business Situations and Prospects in the United States," by Charles R. Flint, and "Recent Discoveries in Greece and the Mycenaean Age."

THE HOBART ELECTRIC MANUFACTURING COMPANY, Troy, Ohio, is manufacturing and placing on the market several styles of 300, 500, and 700-light dynamos and 20, 30 and 50-horse-power motors. These machines are handsomely finished and compactly built, being adapted to take up but small floor space in plants where the room for machinery is limited.

"AMERICAN INDUSTRIALS"—The demand for the publication recently issued by J. S. Bache & Company, of New York city, with special reference to preferred shares as investments, is said to have been so large that the second edition is exhausted and the third is now ready for distribution. The third edition contains full information regarding industrials, brought up to date.

THE KNAPP ELECTRIC AND NOVELTY COMPANY, 125 White street, New York, has made several improvements in this year's type of its battery fan motor. The fans are constructed with noiseless drum wheels and spring adjustable brushes admitting better adjustment while running. They are mounted on mahogany bases and fitted with a starting switch. All the brass parts are finely nickeled and the fan is very attractive in appearance.

THE GUARANTEE ELECTRIC COMPANY, Chicago, Ill., states that its equipment is so complete that it is able to serve its customers no matter what they desire, and wishes to call attention to the bargains it offers in dynamos and similar machinery. A specialty of this company is its electrical repair work and it is stated that it has been so uniformly satisfactory that no complaints have ever been received of any serious nature regarding work done.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., is said to be in receipt of numerous favorable reports from the different plants using its series enclosed alternating arc light system. Economy in operation and ease of management, together with special features of excellence, are said to be winning the approval of central station managers. The most important points claimed for the lamps are their long life, freedom from accidental injury and reliability in action.

THAYER & COMPANY, 39 Cortlandt street, New York, representing the Cahall boilers, recently secured a very handsome order from the Brooklyn Heights Railway Company for its new power-house, to be located at Third avenue and Gowanus Canal, Brooklyn. There will be 24 double-deck boilers aggregating about 16,000 horse-power. Thayer & Company have also sold eight boilers of the same type to the new Citizens' Light and Power Company, of Rochester, N. Y.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., in a recent letter announces that it was a pioneer in the making of alternating-current fan motors and that it has full legal rights to manufacture induction motors with starting coils under the Tesla patents, and is prepared to furnish the most highly improved alternating-current desk and ceiling fans that have ever been placed on the market, at prices that are reasonable and just for the quality of the material used.

WILLIAM ROCHE, 42 Vesey street, New York, is attaining a considerable amount of success with his new standard autogas dry battery. This battery is adaptable for the ignition of gas and gasoline engines and especially for automobile uses. It is compact in design and contained in a wooden box having eight cells. The first part is connected with four cells, and when they cease to be strong enough it is possible to connect one or more at a time until the entire eight are used up. By this method the life of the cells is considerably prolonged and the necessity of a renewal much less frequent.

McCLURE'S MAGAZINE for March contains a number of more than ordinarily interesting articles, among which is a contribution from Mr. George W. Smalley, the American correspondent of the London *Times*, dealing with the character of King Edward VII. Colonel Roosevelt tells of "Reform Through Social Work;" Mr. Edward S. Holden, "What We Know About Mars," and other stories are contributed by Frederic Remington, the artist; Jack London, the Alaskan explorer; Rudyard Kipling, Ida M. Tarbell and others. The magazine also contains a collection of 30 pictures of Queen Victoria, with descriptive text.

AT THE ANNUAL MEETING OF THE CUTLER-HAMMER MANUFACTURING Company, Milwaukee, Wis., all the officers of the company were reelected as follows: F. R. Bacon, president; F. L. Pierce, vice-president; H. H. Cutler, general manager; J. G. Hickcox, secretary and treasurer. This company is renowned for high-class output, and is stated to be the oldest exclusive manufacturer of electric controlling devices in the world. The main office and factory are located at Milwaukee, the eastern factory at Westfield, N. J., and its New York office is at 136 Liberty street. The company announces that "every rheostat that we make and sell is intended to sell more as a result of its operation," which is a very good business principle.

THE BUNNELL TELEGRAPHIC AND ELECTRICAL COMPANY, 110 Beekman street, New York, will soon publish a new catalogue describing its complete line of telephone and telegraph, electrical and street railway supplies. The catalogue will embody about 200 pages of matter, and have a handsome line of half-tone illustrations. The company has just completed and placed on the market a new burglar alarm relay, which has been patented recently. The alarm has a double balance, and is thoroughly dust-proof. This company is also sending out a new learners' telegraph instrument, which has a larger base than usual, and is more elaborately finished. The company has placed on the market many styles of telegraph instruments, and the great care taken in their construction has made a ready sale for them throughout the country.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed a contract with the Tucker Electrical Construction Company, of New York, for the installation of a battery of chloride accumulators for the estate of Henry Villard at Dobbs Ferry, N. Y. The battery is to be used for residence lighting and consists of 68 elements, having a discharge at the normal rating of 280 ampere hours and will be operated in connection with two 12½-kilowatt dynamos driven by two 20-horse-power gasoline engines. For ordinary requirements the battery will be charged during the day and will carry all the lighting load, but on special occasions will be operated in parallel with the dynamos. This battery of "Chloride Accumulators" is to replace a smaller installation made by the Electric Storage Battery Company in October, 1896, and which was destroyed by lightning last Summer.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Mass., is sending out a very unique folder, in the shape of a private reply postal card, to business men throughout the field. The idea of the postal is to place before the business man the practicability of the Ness automatic intercommunicating telephone system. It gives a description of the system, and the advantages of such apparatus in time saving, etc. The company states that if 10 telephones are installed in its system, five separate conversations may take place at one time, without any one interfering with the other; and while two are talking, a third station may be called up, if desired, and the three parties enter into a joint discussion. There is no "Central" required to operate, and each party may make his own connections, the disconnection being automatically performed by replacing the receiver. The telephones themselves are made in several different forms, and are suitable for desk, wall, or table use.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, has issued its new Bulletin No. 2, which deals with the various types of small switchboards put out by this company. It is an excellent example of the printer's and engraver's art, containing 24 pages of valuable information concerning small switchboards and illustrated by about 20 half-tone cuts. The Kellogg "Express" switchboard for small exchanges, the "Universal" type for medium-sized exchanges, and also various "Desk Style" switchboards for branch exchanges in office buildings are illustrated and described. They are adapted for the magneto system or local batteries or for central battery work, and range in size from 50 to 400 lines. This company has recently manufactured a number of small switchboards for use with central battery, with line lamp signals and the lamp double-supervisory system, which are proving very popular with managers of small exchanges. Views are also shown of a number of switchboard details, such as strips of jacks, lamps, rotary and drop signals, combination self-restoring drops and jacks, listening and ringing keys, order wire keys, plugs and cords, etc. A section is also devoted to the Kellogg hook-switch, which was inadequately treated in Bulletin No. 1 on "Telephones." Either of these bulletins will be sent to telephone men upon request.